Enhanced Delivery Options for Injectables
Agenda for Today’s Presentation

Global Trends Impacting Parenteral Therapies
- Advancing patient care
- Total healthcare spending

Enhanced Delivery Case Studies
- Prefilled Syringe Study on Vaccines
- Vial to Ready-to-Use IV Containers

Collaboration Considerations
- Effective collaboration management

Final Conclusions
“The basic issues are the same everywhere: ensuring the widest possible access to care; encouraging innovation to improve care and reduce costs: making sure that profit-making parts of the system do not sacrifice patient care to the bottom line.”

Global Healthcare Trends

Moving Patient Care Forward

- Solutions continue to be sought to increase quality of delivery care
- Reduction of medication errors continues to be a global concern
- Impact of healthcare associated infections are an important wide ranging concern
  - 5% of all hospitalizations in the US
  - 8.7% in WHO cooperative study

To improve patient safety in drug therapy and to ensure the highest quality in medical treatment in European hospitals, the General Assembly of the European Association of Hospital Pharmacists, EAHP, demands:

- The production of single dose-packaged drugs from the pharmaceutical industry
- The mandatory inclusion of a barcode on each single dose

Sources: Hospital-Acquired Infections, eMedicine, July, 20, 2010  Request for the production of single dose-packaged drugs, June 2010, EAHP.
Global Healthcare Trends

Healthcare Spending

- Economic crisis driving austerity measures that could potentially impact national healthcare systems
- Concerns that the aging population will cause increased financial strain
- Increased length of stay due to preventable complications has financial implications

“In all OECD countries total spending on healthcare is rising faster than economic growth, pushing the average ratio of health spending to GDP from 7.8% in 2000 to 9.0% in 2008. Factors pushing health spending up - technological change, population expectations and population ageing - will continue to drive cost higher in the future.”

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Final Conclusions
Case Study: Prefilled Syringe

- Conducted by The Johns Hopkins University Bloomberg School of Public Health
- A study comparing Prefilled Syringes vs. Vials in the Preparation of Vaccines in a Clinic Setting
- Findings were presented at the World Vaccine Congress in April 2010, Washington DC

Source: Originally presented at the World Vaccine Congress presentation. April 20, 2010. Presented by Dr. David Bishai, MD, MPH, PhD Johns Hopkins University Bloomberg School of Public Health. Research conducted by Dr. Bishai and Claudia Pereira, PhD, MS

Baxter
Motivation for Study:
- A clinic’s choice of pre-filled syringes vs. multi-dose vials affects work flow
  - To determine the time differences spent on the different vaccine presentations
  - To determine the resulting economic impact of different vaccine presentations

Overall Study Goals:
- Primary: To measure time and labor costs of influenza vaccination administered via pre-filled syringes vs. multi-dose vials
- Secondary: To observe adherence to and deviations from best practices in the preparation of vaccines

Previous Research: This has been previously been studied, but outside the US:
- France: Detournay et al., 1998
- Canada: Scheifele et al., 2000
- Japan: Kuroyama, 2009

Method: Observation during the 2009-2010 influenza campaign
- in 7 clinics, observing 39 Healthcare Workers preparing over 1,000 injection preparations

Case Study: Prefilled Vaccine
## Vaccine Packaging and Delivery Systems

Vaccine packaging and delivery systems will impact the vaccination administration process.

### Vial & Disposable Syringes

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Uncap vaccine vial</td>
</tr>
<tr>
<td>2.</td>
<td>Swab stopper with swab</td>
</tr>
<tr>
<td>3.</td>
<td>Unwrap syringe</td>
</tr>
<tr>
<td>4.</td>
<td>Unwrap needle</td>
</tr>
<tr>
<td>5.</td>
<td>Assemble needle to syringe</td>
</tr>
<tr>
<td>6.</td>
<td>Inject needle into vial</td>
</tr>
<tr>
<td>7.</td>
<td>Draw vaccine into syringe</td>
</tr>
<tr>
<td>8.</td>
<td>Assure accurate dosage drawn</td>
</tr>
<tr>
<td>9.</td>
<td>Passively recap needle</td>
</tr>
<tr>
<td>10.</td>
<td>Remove needle from syringe and dispose</td>
</tr>
<tr>
<td>11.</td>
<td>Unwrap new needle and assemble onto syringe</td>
</tr>
<tr>
<td>12.</td>
<td>Inject vaccine into patient</td>
</tr>
</tbody>
</table>

### Manufacturer Prefilled Systems (MPFS)

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Remove prefilled syringe cap</td>
</tr>
<tr>
<td>2.</td>
<td>Unwrap needle,</td>
</tr>
<tr>
<td>3.</td>
<td>Assemble needle to prefilled syringe</td>
</tr>
<tr>
<td>4.</td>
<td>Inject vaccine into patient</td>
</tr>
</tbody>
</table>
# Results: Tasks and Time for Vials and PFS

<table>
<thead>
<tr>
<th>Vial Tasks</th>
<th>Common Tasks</th>
<th>Pre-filled Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove vial from box</td>
<td>Don gloves</td>
<td>Open PF box (5 or 10)</td>
</tr>
<tr>
<td>Unpack syringe</td>
<td>Vaccine from fridge</td>
<td>Remove tracking #</td>
</tr>
<tr>
<td>Split needle packs</td>
<td>Open box of needles</td>
<td>Attach PF to needle</td>
</tr>
<tr>
<td>Attach fill needle</td>
<td>Split needle packs</td>
<td>Uncap/dispose</td>
</tr>
<tr>
<td>Expose stopper</td>
<td>Unwrap one needle</td>
<td>TOTAL: 12.42</td>
</tr>
<tr>
<td>Sterilize vial</td>
<td>Tidy up</td>
<td></td>
</tr>
<tr>
<td>Fill/Measure from vial</td>
<td>TOTAL: 8.64</td>
<td></td>
</tr>
<tr>
<td>Unwrap new needle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affix new needle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncap/cap/dispose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Write tracking #</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Time = 49.71 (A)

Difference between MDV and PFS (A-B) = 37.29 Seconds

Total Time = 12.42 (B)
### Results: Administration Costs

<table>
<thead>
<tr>
<th>Resources</th>
<th>MDV</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Units</td>
<td>Price $</td>
<td>Total US$</td>
<td>Units</td>
<td>Price US$</td>
<td>Total US$</td>
</tr>
<tr>
<td>Staff Time (Hrs)</td>
<td>13.81*</td>
<td>$35.75/Hr</td>
<td>493.71</td>
<td>3.45**</td>
<td>$35.75/Hr</td>
<td>123.34</td>
</tr>
<tr>
<td>Syringe</td>
<td>1000</td>
<td>0.39/unit</td>
<td>390.00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Needles</td>
<td>2000</td>
<td>0.31/unit</td>
<td>620.00</td>
<td>1000</td>
<td>0.31/unit</td>
<td>310.00</td>
</tr>
<tr>
<td>Alcohol</td>
<td>1000</td>
<td>0.03/unit</td>
<td>30.00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Gloves</td>
<td>1000</td>
<td>0.08/unit</td>
<td>80.00</td>
<td>1000</td>
<td>0.08/unit</td>
<td>80.00</td>
</tr>
<tr>
<td>Storage (doses/month)</td>
<td>1000</td>
<td>0.00045/unit</td>
<td>0.45</td>
<td>1000</td>
<td>0.0044/unit</td>
<td>4.40</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$1,614.16</td>
<td></td>
<td></td>
<td>$517.74</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td></td>
<td>$1,096 per 1000 doses</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Time units exclude mutual tasks to facilitate calculations
**Excludes the acquisition cost of vaccine
Using pre-filled syringes would save $1.10 per dose in administration costs if the price per dose of flu vaccine was the same

- A vaccine packaged in a PFS priced $1.10 higher than a vial has the same net cost to deliver to patient
- Savings is lower if health worker salaries and needle costs are lower; higher if the opposite is true.

Actual prices vary when considering list and market pricing with PFS ranging from $0 to $3.50 higher than vials

Implications of 37.29 second gap:
- American birth cohort of 4 million infants encounters about 15 shots before age 1
  - Pre-filled syringes would save 621,500 person hours worth $22.2 million in health worker time
- In a pandemic where 300 million Americans required vaccination
  - Pre-filled syringes would save 3.12 million hours worth $111.1 million in health care worker time
Example 1:
Reuse of syringes with a multi-dose vials when administering at least 36 flu vaccines. A single syringe which held up to six doses was used on multiple patients.

Example 2:
In January 2010, Schofield Elementary School in Wellesley, MA:
- School staff received insulin instead of H1N1 vaccine
- Insulin belonged to a student and was stored in the same refrigerator

January 2008: Dr. E. Jacob Simhaee, Long Island, NY.


Source: http://multimedia.boston.com/m/28435510/insulin-mistaken-for-h1n1-vaccine-in-wellesley.htm
Study Conclusions

Vaccine Presentation Matters

- In Impacting Clinical Efficiency: It takes more than one extra hour to prepare 100 doses with a Vial vs. a PFS
- In Impacting Clinic Costs: Excluding acquisition costs, vaccines packaged in prefill syringes reduce administration costs by $1.10/dose
- In Minimizing Deviations from Best Practices in Vaccine Preparation: Increased number (+8) of steps results in significant observed deviations from published guidelines on best practices

Enhanced delivery in IV containers also matters . . .
Market Research: IV Ready-to-Use (RTU) Containers

- **2009 Second Consensus Development Conference on the Safety of Intravenous Drug Delivery Systems**
  - US panel convened to evaluate the relative safety and cost of available nonelectronic I.V. drug delivery systems for parenteral medications

- **2009 Study to understand clinical preference of Ready-to-Use (RTU) IV containers**
  - Vial conversion to RTU IV containers, impact on share and pricing strategy

- **Post-patent expiry preference for RTU IV containers**
  - Data over lifecycle of drugs in a ready-to-use IV container

- **2010 panel discussion of RTU supporting Pharmacy objectives**
  - Implementation of RTU increases available time for clinical involvement and patient care

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Benefits</th>
<th>Problems</th>
</tr>
</thead>
</table>
| Manufacturer ready-to-use          | • Low risk for contamination  
                                • Ease of use and dispensing  
                                • Maximum available expiration dating | • Products not available for special populations  
                                • Pharmacoeconomic data lacking  
                                • Frozen products may require thawing |
| Outsourced ready-to-use            | • Can customize dose for each patient  
                                • Lower risk for contamination | • Cost analysis suggested  
                                • Requires advance planning and storage |
| Point of care activated            | • Works well with automated cabinets  
                                • Maximum available expiration dates | • Products not available for special Populations  
                                • Cost analysis suggested  
                                • Risk of inactivation errors |
| Pharmacy Compounded                | • Can customize dose for each patient  
                                • Significant quality control  
                                • Labeled in accordance with hospital standards | • Risk of contamination  
                                • Significant operational requirements related to *USP chapter 797* |
| Non-pharmacy compounded at point of care | • Can customize dose for each patient  
                                • Immediate availability | • High potential for error  
                                • Low compliance with regulatory requirements  
                                • Labeling typically handwritten or absent  
                                • Risk of contamination |
## Consensus Panel Ranking of I.V. Drug Delivery Systems

<table>
<thead>
<tr>
<th></th>
<th>Manufacturer Ready-to-use</th>
<th>Outsourced Ready-to-use</th>
<th>Point-of Care Activated</th>
<th>Pharmacy Compounded</th>
<th>Non-pharmacy Compounded at point of care</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applicability</strong></td>
<td>4.0</td>
<td>5.4</td>
<td>3.6</td>
<td>6.7</td>
<td>5.8</td>
</tr>
<tr>
<td><strong>Ease of Use</strong></td>
<td>6.2</td>
<td>5.5</td>
<td>4.9</td>
<td>3.7</td>
<td>3.6</td>
</tr>
<tr>
<td><strong>Regulatory compliance</strong></td>
<td>6.5</td>
<td>5.2</td>
<td>6.0</td>
<td>3.5</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>4.0</td>
<td>3.4</td>
<td>4.1</td>
<td>3.8</td>
<td>4.9</td>
</tr>
<tr>
<td><strong>Safety</strong></td>
<td>6.0</td>
<td>4.5</td>
<td>4.6</td>
<td>4.2</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Implementation</strong></td>
<td>6.0</td>
<td>4.9</td>
<td>4.7</td>
<td>3.6</td>
<td>2.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>32.7</strong></td>
<td><strong>28.9</strong></td>
<td><strong>27.9</strong></td>
<td><strong>25.5</strong></td>
<td><strong>20.5</strong></td>
</tr>
</tbody>
</table>

Manufacturer ready-to-use products ranked the highest of all Drug Delivery Systems

Interviews conducted with 450 hospital pharmacists
- Participants were required to be involved in hospital formulary decision making
- Minimum 3 years experience with IV therapy and drug delivery systems
- Review of all relevant systems to ensure share impact was fully characterized

Ready-to-use IV premix was preferred to vial based admixture
- Minimum 30% share gain

Demand for premix is as strong at a premium as it is at parity to a vial

Further detailed information available upon request

Global Pharmacy Objectives Align

US Pharmacists’ panel support premix benefits, August, 2010

- Implementation of premix supports the goal of Pharmacists to increase direct involvement in patient care
- Recognition that the required and necessary oversight of IV admixture process increases total cost
- Pharmacy admixture introduces human factors and the potential for error that the panelists are actively trying to reduce

FIP Global Conference on the Future of Hospital Pharmacy, Final Basel Statements, 4th December 2008

- The overarching goal of hospital pharmacists is to optimize patient outcomes through the judicious, safe, efficacious, appropriate, and cost effective use of medicines.
- Procurement should be guided by the principle of procuring for safety
- Hospital pharmacists should be involved in all patient care areas to prospectively influence collaborative decision-making

The overarching goal of hospital pharmacists is to optimize patient outcomes through the judicious, safe, efficacious, appropriate, and cost effective use of medicines. Procurement should be guided by the principle of procuring for safety. Hospital pharmacists should be involved in all patient care areas to prospectively influence collaborative decision-making.

The overarching goal of hospital pharmacists is to optimize patient outcomes through the judicious, safe, efficacious, appropriate, and cost effective use of medicines. Procurement should be guided by the principle of procuring for safety. Hospital pharmacists should be involved in all patient care areas to prospectively influence collaborative decision-making.
Enhanced packaging share retention post patent expiry

Source: IMS market information and Internal data
Global Trends Impacting Parenteral Therapies

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- Total healthcare spending

Enhanced delivery case studies:

- Prefilled Syringe Study on Vaccines
- Vial to Ready-to-Use IV Containers

Collaboration considerations

- Effective collaboration management

Final Conclusions
Pharmaceutical and Biotech companies may gain a competitive edge by partnering or outsourcing select elements of their strategy to help manage costs and maintain core capabilities for other existing products.

Working with a partner can provide access to specific technical expertise and specialized drug delivery technologies.

It is important to find a partner that employs multidimensional strategies to achieve your objectives

- Investing in research related to the clinical use of enhanced delivery systems as it relates to optimized patient outcomes, health economics, and the interface of the patient and healthcare worker
- Integrating best practices from project management, customer service, and Lean methodologies while utilizing continuous improvement and learning principles

These considerations can drive value for both parties entering into a collaboration.
To Conclude…

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- Total healthcare spending

Enhanced delivery case studies:

- Prefilled Syringe Study on Vaccines
- Vial to Ready-to-Use IV Containers

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Final Conclusions
Enhanced Delivery Systems
Support Objectives

**Enhanced patient care**
- Manufacturer prepared ready-to-use delivery systems support global initiatives to move patient care forward
  - Reduced likelihood of admixture related contamination
  - Manufacturer prepared labeling supports initiatives relating to the identification of unit dose of drugs

**Improved total delivered cost**
- In a vaccination clinic setting, the use a prefilled syringe can save $1.10 per dose in injection preparation costs vs. a vial
  - RTU IV containers support labor efficiency objectives

**Potential lifecycle management**
- Share gain reflects clinical preference and impact of larger environmental issues relative to the delivery of care
- Pricing of RTU products can be used as an additional tool to increase adoption
Thank You for Participating!

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