

## **R&D STEM Learning Exchange: Baxter Challenge**

### **Introduction: About Baxter International Inc.**

Millions of patients and healthcare professionals rely on Baxter every day. Their products are essential building blocks of care and in delivering cost-effective healthcare solutions. Baxter's mission is to save and sustain lives. Baxter products and therapies can be found on nearly every floor, in every department, in almost every hospital worldwide. You'll find them in clinics and in the home. Patients and providers rely on Baxter for lifesaving renal and medical products, including intravenous (IV) solutions, systems and administrative sets, IV infusion parenteral nutrition, perioperative care, pharmacy devices and software, acute renal care, and home and in-center dialysis.

Baxter has two global business units: Hospital Products and Renal. Baxter's Hospital Products business manufactures products used in the delivery of fluids and drugs to patients across the continuum of care. These include IV and other sterile solutions and administration sets, premixed drugs and drug-reconstitution systems, IV nutrition products, infusion pumps, and inhalation anesthetics. Baxter's Renal portfolio addresses the needs of patients with kidney failure or kidney disease, and their healthcare providers, with a comprehensive range of therapeutic options across home, in-center, and hospital settings for better individualized care. Baxter scientists are also pursuing a range of next-generation monitors, dialyzers, devices, dialysis solutions, and connectivity technology for home patients.

Baxter's 50,000 employees serve patients and clinicians in more than 100 countries. They are dedicated to ensuring Baxter is there when patients need care, from hospitals and clinics to homes in rural areas and major cities. Baxter is also dedicated to supporting the pioneering efforts of clinicians who are focused on innovative research and science education that elevates student interest in math and science.

### **The Baxter Challenge**

According to a statistical brief from the Agency for Healthcare Research and Quality, in 2012 there were 36.5 million hospital stays in the United States, with an average length of stay of 4.5 days and an average cost of \$10,400 per stay.<sup>1</sup> Healthcare trends over the last few decades show decreases in the length of hospital stays. Shorter hospital stays can decrease the likelihood of hospital-acquired infections, can increase healing as patients are in their own home environment, and decrease medical costs. Furthermore patients with chronic health issues can increasingly be treated at home as a result of improvements in medical technology.

Two major areas of medical innovations where Baxter has made an impact are in parenteral nutrition and dialysis. These innovations have improved the health outcomes and lives for countless patients while in hospitals and clinics. Increasingly Baxter

research and development is focused on expanding the range of treatment options beyond in-center care for patients. How can patients receive ongoing treatment while in their homes? How can patients in rural communities around the world access the same level of quality healthcare options as patients located near large urban medical facilities?

Baxter would like to hear from you as the next generation of scientists and innovators about ways to improve these home health care technologies. Your challenge is to research renal dialysis and parenteral nutrition, focusing on treatment and care that can take place in the home. Consider areas of improvement and design innovation around administering medical treatment, information sharing between patient and healthcare providers, necessary aseptic techniques, and global solutions. **What new design innovations to new or existing approaches would you suggest to Baxter in order to improve usability, accessibility, and patient healthcare outcomes?**

<sup>1</sup> [Weiss, A. and Elixhauser, A., Overview of Hospital Stays in the United States, Agency for Healthcare Research and Quality. 2014.](#)

### **Predicted Problem Statement**

In order to investigate this problem, you will need to consider the following questions:

What is dialysis?

- What types of health conditions require dialysis treatment?
- What is the difference between the hemo and peritoneal dialysis?
- What are the treatment options both at home and in-center?
- What is the current state of at home treatment? What is required of patients?
- What are the advantages and disadvantages of home treatment?
- Review Baxter Patient Stories – [Maddy Warren](#), [Yin Le](#), and [Li Mingda](#)

What is parenteral nutrition?

- What is the difference between parenteral vs. enteral nutrition?
- What types of health conditions necessitate parenteral nutrition?
- How is parenteral nutrition given at home vs. in-center treatment?
- What are the advantages and disadvantages of parenteral nutrition at home?
- Review Baxter Patient Stories: [Elizabeth Tucker](#)

How might in-home treatment and technology have positive impacts on patients?

- How might technology improve patient compliance?
- How might you improve the usability of the medical devices?
- What design suggestions might improve accessibility for patient populations with special needs, e.g. hearing or vision impaired?
- What design solutions might improve the usability, accessibility and/or compliance for certain populations, such as children and teenage patients?

How can technology improve patient health outcomes through information sharing?

- What biometric information from the patient might be helpful to be shared with physicians and other providers, e.g. weight, blood pressure, blood sugar?
- How might medical mobile apps assist with patient care related to dialysis and/or parenteral nutrition, e.g. support, reminders, etc?
- How might smart homes contribute to medical treatment and information sharing?
- How might information sharing through the medical devices assist with troubleshooting the devices?
- What are the patient privacy rules and regulations applicable to information sharing with physicians, other providers, and companies like Baxter who design and manufacture the devices?

What aseptic techniques are necessary for in-home treatment with dialysis and/or parenteral nutrition?

- What requirements are necessary for the current devices?
- What are the areas of concern and how do they affect patient health?
- What recommendations would you make to improve aseptic technique by patients and home healthcare providers?
- What other requirements, such as clean water supply, are critical for in-home dialysis and parenteral nutrition?

Consider areas that are non-western, developing countries. What additional challenges exist for parenteral nutrition and dialysis machines?

- How is clean water an additional challenge in these environments?
- How is aseptic technique an additional challenge?
- How are doctors, patients, and companies like Baxter currently dealing with these additional challenges?
- What additional recommendations and design ideas would you suggest for global challenges?

## **Potential Resources**

### Dialysis

- Baxter Patient Stories – [Maddy Warren](#), [Yin Le](#), [Li Mingda](#)
- [The National Kidney Foundation](#) is an organization in the U.S. dedicated to the awareness, prevention and treatment of kidney disease for hundreds of thousands of healthcare professionals, millions of patients and their families.
- [Home Dialysis Central](#) is a program of the non-profit [Medical Education Institute](#) dedicated to helping people with chronic diseases learn to manage and improve their lives.

- The National Institutes of Health division of the [National Institute of Diabetes and Digestive and Kidney Disease](#) has information on home dialysis for providers and patients.
- [The Mayo Clinic](#) has a wealth of patient information on healthcare conditions and treatments.
- [The American Association of Kidney Patients](#) has education information for patients as well as patient first person stories.

### Parenteral Nutrition

- Baxter Patient Stories: [Elizabeth Tucker](#)
- [Baxter's Nutrition Academy](#) provides information for US healthcare providers who provide parenteral nutrition.
- [The American Society for Parenteral and Enteral Nutrition](#) is a community of practitioners dedicated to improving the science and practice of nutrition services.
- [The American College of Gastroenterology](#) has information for both patients and practitioners about nutrition options at home and in-center.
- [The Mayo Clinic](#) has a wealth of patient information on healthcare conditions and treatments.
- [The Children's Hospital of Pittsburgh](#) has a great information article with Q&A for parents of children requiring home parenteral nutrition.
- [The Oley Foundation](#) is a support network for patients and caregivers requiring home IV feeding. The patient stories illustrate the real life stories of patients and their journey towards continuous in home care.

### Research sites for innovation and ideas

- HIPAA Privacy information can be found at the [US Department of Health and Human Services](#).
- [The Food and Drug Administration](#) has resources on Mobile Medical Apps as well as a [great article](#) on the home health environment and medical devices.
- The [National Center for Biotechnology Information](#) is a government funded national resource that has research articles about a variety of topics including technology and [its changing role in medicine](#).
- [HealthIT.gov](#) has information for patients, parents, and providers about technology and the medical field.
- Partners Health has a [Connected Health site](#) that describes current trends and innovations in connected health.
- [The American Telemedicine Association](#) is the leading international resource and advocate promoting the use of advanced remote medical technologies.
- [Connected Health: How Mobile Phones, Cloud and Big Data Will Reinvent Healthcare](#) is a book by Dr. Jody Ranck from 2012.
- [This article](#) from the Agency for Healthcare Research and Quality describes human factors engineering and the importance in medical devices.

- [The National Center for Human Factors in Healthcare](#) unites engineers with health care providers to engage in research and innovation.
- The [World Health Organization](#) is a great resource for researching the practice of medicine in developing countries. Also check out [this article](#) about human factors engineering.
- The National Academy of Engineering lists [14 Engineering Grand Challenges](#) for the next decade including health informatics and access to clean water.