



Corporate Presentation

(NASDAQ: CHFS)

December 2018



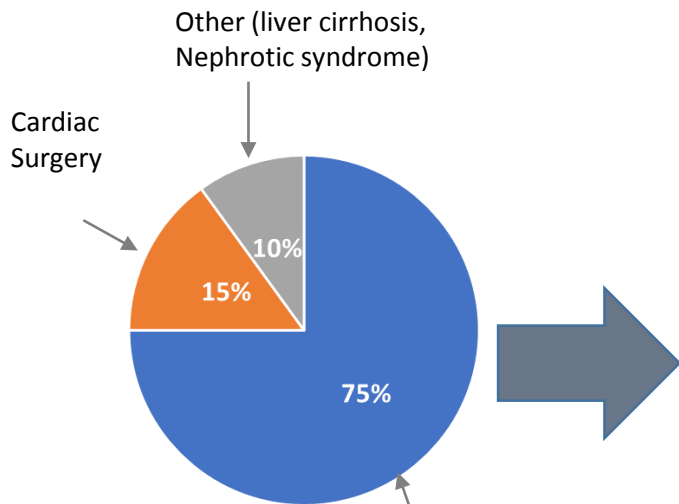
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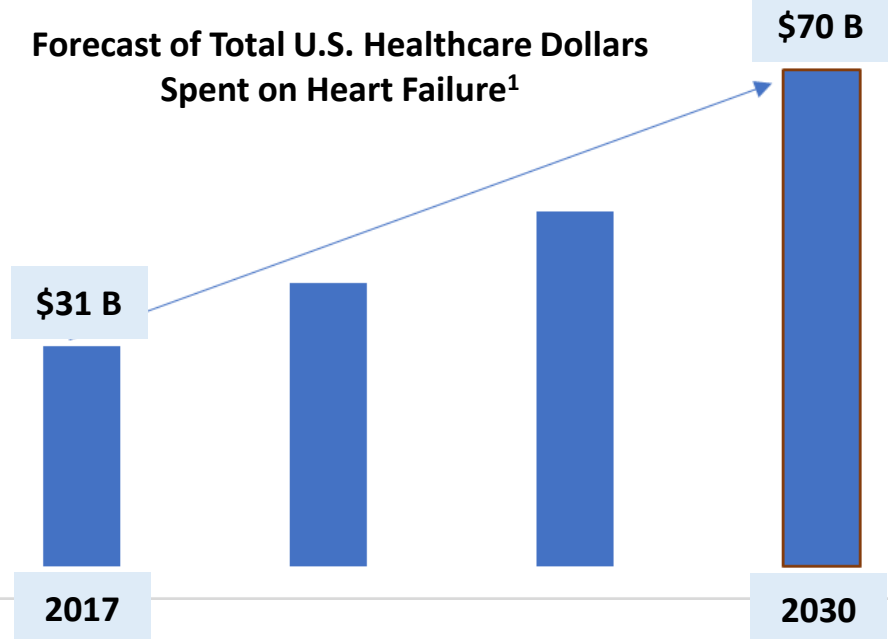
Aquadex Flex Flow® is a registered trademark of CHF Solutions, Inc.

Fluid Management Market Size is Large and Growing



Congestive Heart Failure (CHF) represents approx. 75% of total U.S. Fluid Management market²

Forecast of Total U.S. Healthcare Dollars Spent on Heart Failure¹



Fluid Overload in Heart Failure is a significant burden on the U.S. Healthcare System

Congestive Heart Failure (CHF) is the leading cause of fluid overload– and is the Company's primary disease target

¹ Circ Heart Fail. 2013 May

² McKinsey study internal document 2012

Fluid Overload in Heart Failure Patients is Overwhelming

6.5M

- U.S. patients with HF and expected to rise to 8M patients by 2030^{1,2}
- HF is the largest driver of Medicare costs

>1 M

- Annual U.S. and EU heart failure hospitalizations³
- Congestion (fluid overload) is primary cause³

90%

- Heart failure hospitalizations are due to fluid overload³

¹ Benjamin EJ. et al, 2017 Update: A Report from the American Heart Association. Circulation. 2017; 135(10):e146-e603

² Savarese G, Lund L, Card Fail Rev. 2017; 3(1): 7-11

³ Costanzo MR, et al. J Am Coll Cardiol. 2017;69(19):2428-2445.

Diuretics are the Standard of Care, but Fail to Provide Optimal Outcomes in Many Patients

- 40% Of patients demonstrate **diuretic resistance** ("failure") and 68% show **sub-optimal response**¹
- 68% Of HF patients are discharged from the hospital with residual excess fluid²
 - Worsening heart failure with **increased mortality** after discharge
 - Insufficient symptom relief, such as **persistent congestion**
 - Increase in **re-hospitalization** rates
 - Risk of **electrolyte imbalance** (i.e. low magnesium and low potassium)



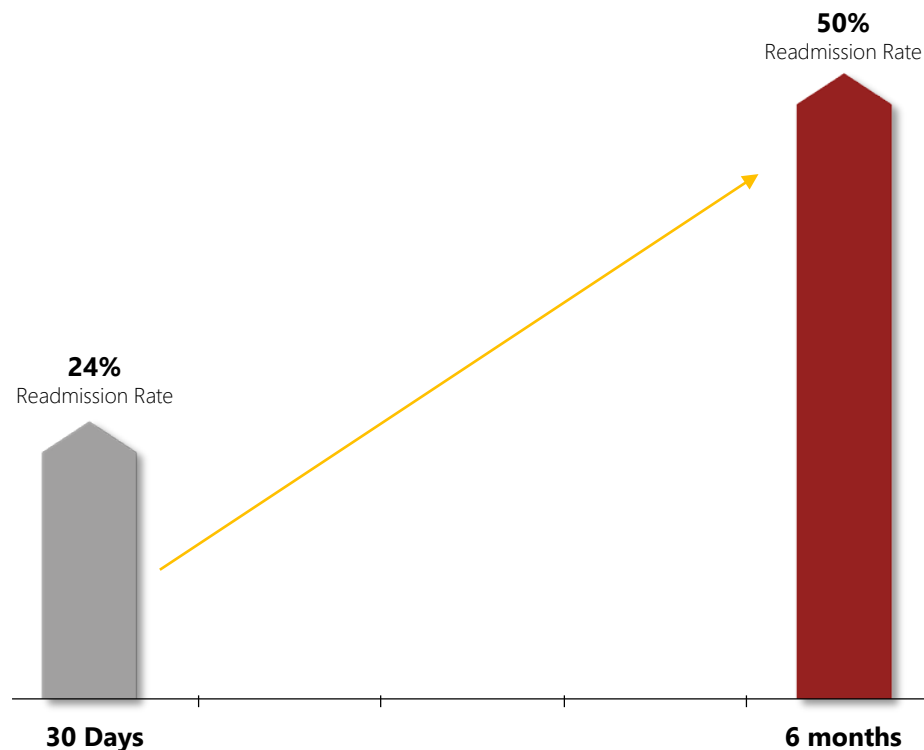
¹ Testani, Circ Heart Failure, 2016;9:e002370

² Costanzo MR, et al., J Am Coll Cardiol., 2017; 69: 2428-45

Fluid Overload in HF Patients is a Recurrent Problem

Recurrent fluid overload in heart failure is associated with worse outcomes independent of age and renal function

- 24% Of patients are readmitted within 30 days of hospital release¹
- 50% Of patients are readmitted within 6 months of hospital discharge¹
- Adds to the economic cost burden



¹ Costanzo MR, et al. J Am Coll Cardiol. 2017 May 16;69(19):2428-2445

Medicare Penalizes Hospitals with Excessive HF Readmissions

In 2012 the Affordable Care Act instituted the Hospital Readmission Reduction Program¹

- **Requirement:** CMS to reduce payments to hospitals with excess readmissions
- **Penalty:** hospitals can lose $\leq 3\%$ of Medicare reimbursement on all admissions
- **2017 Update** from Journal American Medical Association (JAMA):²
 - **Decrease in heart failure related readmissions but increase in 30-day and 1 year mortality rates**

¹ Readmissions Reduction Program (HRRP). Centers for Medicare & Medicaid Services website. Updated April 18, 2016. Accessed May 25, 2016.

² Journal of the American Medical Association (JAMA), November 2017



Aquadex FlexFlow® System

A Solution to this Unmet Clinical Need

- 40% More fluid removal than conventional diuretic drug therapy over the same period of time¹
- No clinically significant impact on electrolytes balance, blood pressure, or heart rate^{1,2}
- 53% Reduction in the risk of rehospitalization than those treated solely with diuretics at 90 days³
- Fewer re-hospitalization days due to cardiovascular event⁴

¹ Bart BA, et. al., *Am Coll Cardiol.*, 2005;46:2043–6

² Jaski BE et al. *J Card Fail.* 2003; 9(3):227-231

³ Costanzo MR, et al. *J Am Coll Cardiol.* 2007 Feb 13; 49(6): 675-683.

⁴ Costanzo MR, et. al., *J Am Coll Cardiol.*, 2005;46:2047–51.



The Value and Utility Advantages of Aquadex FlexFlow® are Compelling

- **Safe, effective**, and **clinically proven** to remove excess salt and water from the body
- Rapid and predictable rate of fluid removal
- Efficient patient to nurse workflow
- Prescribed by any medical specialty
- Customizable therapy plan based on provider's clinical goals for their patient



Compelling Clinical Results Demonstrate the Potential of Aquadex FlexFlow®

Good Samaritan Hospital- A Single Center Experience

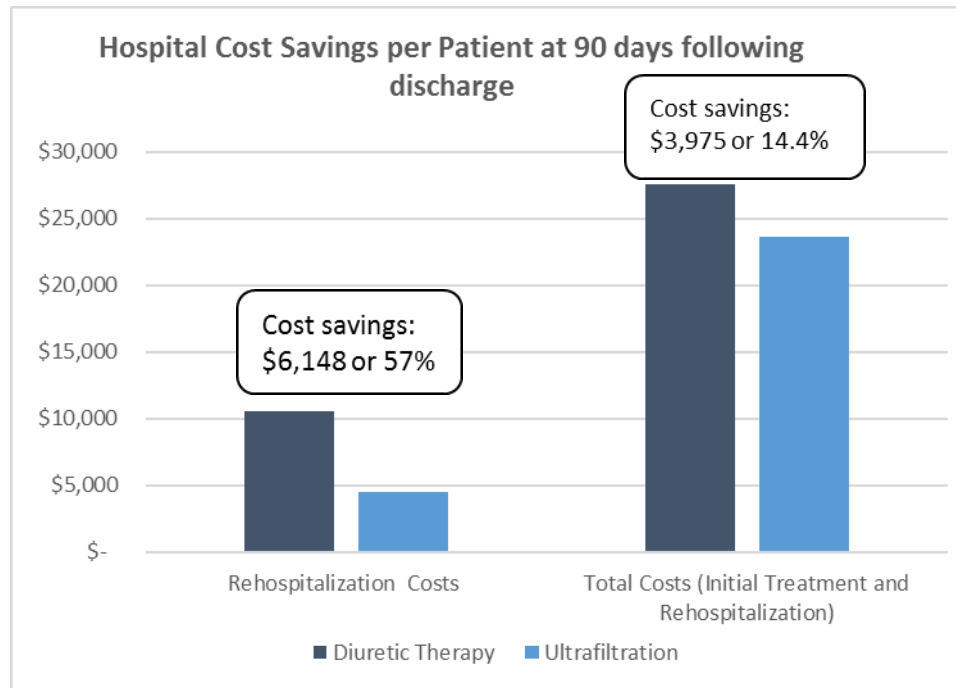
Independent study of 67 heart failure patients who received aquapheresis:

- No 30-day readmits for volume overload
- Length of stay when started within 24 hours was 2.2 days, compared to national average of 5.9 days
- Readmission rate from before aquapheresis down from 12% to 4% the year prior
- Average of 5.7 liters removed per patient

*Data presented at the National Teaching Institute & Critical Care Exposition (NTI) in Chicago, IL on May 5-8, 2008. Results may vary.



New Data Shows Ultrafiltration Therapy Demonstrates a Cost Savings at 90 Days



Cost savings from reduced hospital readmission days were **\$3,975 (14.4%)** at 90-days:

- IV Diuretics costs: \$27,608
- Ultrafiltration costs: \$23,633

Despite higher up-front costs, ultrafiltration reduces hospital readmission rates and duration, which substantially lowers costs over a 90-day period compared to IV diuretics.

Costanzo MR, et al. Ultrafiltration vs. Diuretics for the Treatment of Fluid Overload in Patients with Heart Failure: A Hospital Cost Analysis. Poster presented at the ISPOR International Meeting, May 19-23, 2018, Baltimore, MD, USA

Clinical Guidelines Support Use of Ultrafiltration



ACC/AHA – American College of Cardiology/ American Heart Association¹

Ultrafiltration may be considered for patients with obvious volume overload to alleviate congestive symptoms and fluid weight, or with refractory congestion not responding to medical therapy

HFSA - Heart Failure Society Of America²

Ultrafiltration may be considered in lieu of diuretics

ESC / HFA - European Society of Cardiology and Heart Failure Association³

Venovenous isolated ultrafiltration is sometimes used to remove fluid in patients with HF, although is usually reserved for those unresponsive or resistant to diuretics

CCS - Canadian Cardiovascular Society⁴

Patients with persistent congestion despite diuretic therapy, with or without impaired renal function, may, under experienced supervision, receive continuous venovenous ultrafiltration

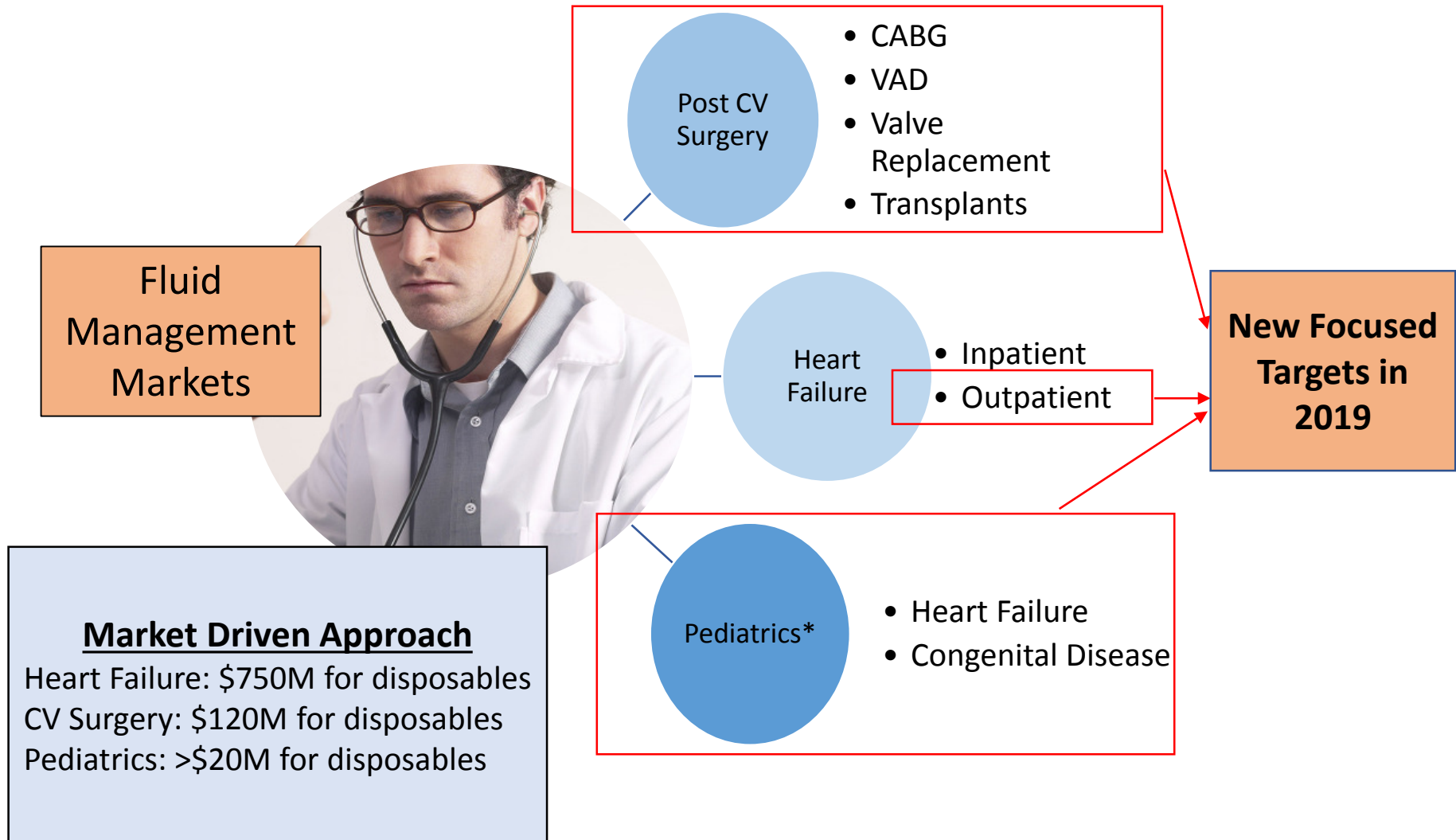
¹ Yancy CW, et al. *J Am Coll Cardiol*. 2013 Oct 15; 62(16): e147-e239.

² HFSA 2010 Comprehensive Heart Failure Practice Guidelines: Lindenfeld J, et al. *J Card Fail*. 2010 Jun; 16(6): 475 – 539.

³ ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure 2012: McMurray JJ, et al. *Eur Heart J*. 2012 Jul; 33(14): 1787 – 1847.

⁴ 2012 Canadian Cardiovascular Society Heart Failure Management Guidelines Update: McKelvie RS, et al. *Can J Cardiol*. 2013 Feb; 29(2): 168 – 181.

Current & Future Target Markets



* Subject to regulatory clearance

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New Market Opportunity – Cardio-Vascular Surgery

- 7.3M Cardiovascular operations and procedures per year in the US¹
 - 500,000+ Coronary Artery Bypass Grafts (CABG) per year in US²
 - 80,000 Valve procedures per year in US³
- 4-6 Liters of fluid added to maintain cardiac output and blood pressure to accommodate anesthesia and bypass machine⁴
- CV surgery is being safely performed on patients 80+ years due to advances in cardiopulmonary bypass techniques



¹ National Center for Health Statistics 2009

² Coronary Artery Bypass Graft (CABG) Market Analysis By Type (Saphenous Vein Grafts, Internal Thoracic Artery Grafts), By Surgical Procedures, By Technology (On-Pump CABG, Off-Pump CABG), And Segment Forecasts, 2018 – 2025, Grand View Research

³ iData Research: <https://idataresearch.com/over-182000-heart-valve-replacements-per-year-in-the-united-states/>

⁴ Pradeep A, Rajagopalam S, Kolli AK, et al. HSR Proceedings in Intensive Care and Cardio Anesthesiology 2010; 2: 287-296

Multiple CV Surgical Procedures & Multiple Prescribers

- Aquadex FlexFlow® therapy can be used after cardiac procedures to remove fluid overload when diuretics fail
 - Valve repair or replacement
 - CABG (Coronary Artery Bypass Graft)
 - LVAD (Left Ventricular Assist Device) Implant
 - Heart Transplant
- Prescribers can include:
 - CT Surgeons
 - Surgical PA
 - Intensivists
 - Cardiologist



CV Surgery Post Operative Complications Are Significant

- Volume Overload – Due to IV fluids and medication inhibits healing
- Potential acute kidney injury from bypass machine and anesthesia
 - Affects up to 30% of patients¹
 - Fluid overload and rises in serum creatinine associated with longer ICU stays and increased mortality²
- Prolonged intubation
 - Excessive fluid and pulmonary edema causes respiratory issues
 - Associated with increased mortality³

¹ O'Neal JB, Shaw AD, Billings FT (2016) Acute kidney injury following cardiac surgery: current understanding and future directions. Crit Care 20(1):187.
doi: [10.1186/s13054-016-1352-z](https://doi.org/10.1186/s13054-016-1352-z)

² Stein A, de Souza LV, Belettini CR, Menegazzo WR, Viégas JR, Costa Pereira EM, et al. Fluid overload and changes in serum creatinine after cardiac surgery: predictors of mortality and longer intensive care stay. A prospective cohort study. Crit Care. 2012;16:R99

³ Federico Pappalardo, Annalisa Franco, Giovanni Landoni, Paola Cardano, Alberto Zangrillo, Ottavio Alfieri; Long-term outcome and quality of life of patients requiring prolonged mechanical ventilation after cardiac surgery, *European Journal of Cardio-Thoracic Surgery*, Volume 25, Issue 4, 1 April 2004, Pages 548–552, <https://doi.org/10.1016/j.ejcts.2003.11.034>

CHF Solutions' Business Overview

- Aquadex FlexFlow® therapy is ultrafiltration to reduce fluid overload in patients, when diuretics fail
- Designed to be used by cardiologists early in the heart failure treatment protocol
- Growing opportunity in treating fluid overloaded patients post CV surgery
- Acquired from Baxter in August 2016 and now manufacturing all products in our Eden Prairie, MN facility
- FDA 510(k) market cleared; sold internationally with the CE mark
- Recently expanded US sales team to 13 sales territories and 5 clinical specialists
- Distribution partners in UK, Italy, Germany, Spain, Singapore, Hong Kong and Thailand



Aquadex FlexFlow® Product Overview

**Aquadex FlexFlow
Console**



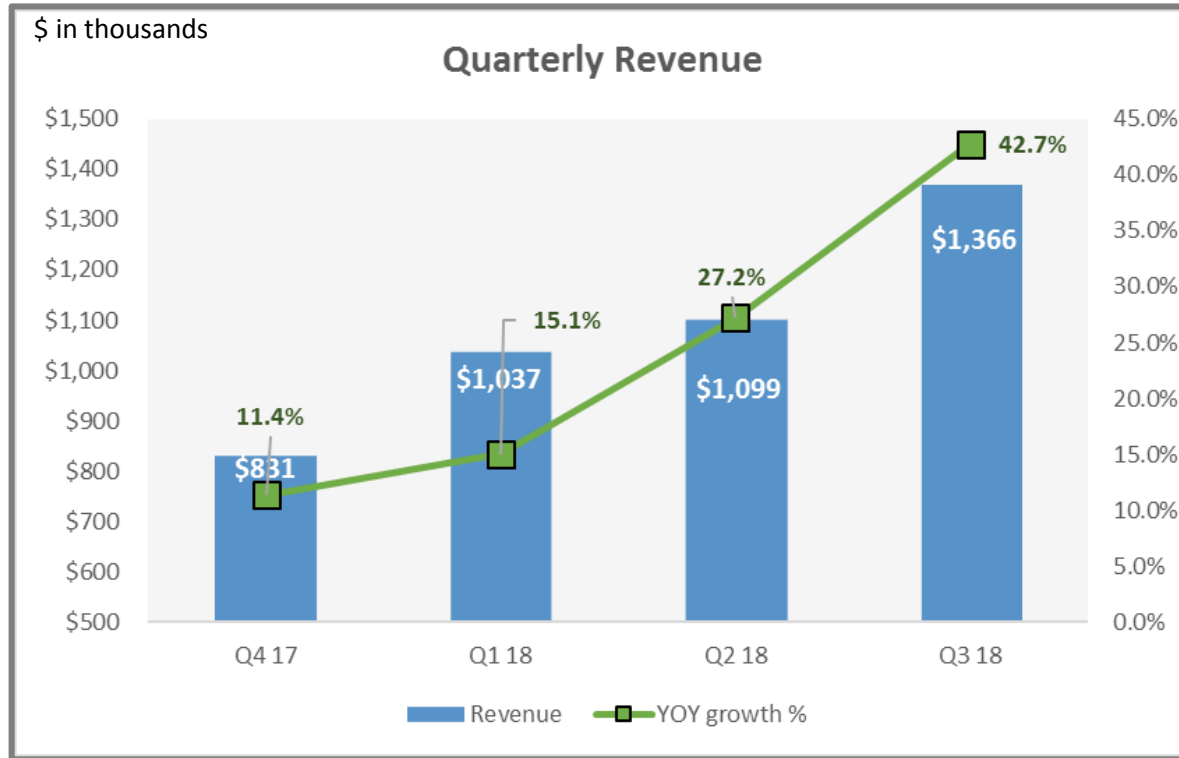
Blood Circuit Set



**Dual Lumen
venous catheter**



Revenue Performance



We have delivered double-digit year over year quarterly growth for the last 6 quarters

Capitalization Table

As of September 30, 2018

Instrument	Shares	Comments
Common Shares	7,074,407	Nasdaq: CHFS
Common Stock Equivalents		
Series F Convertible Preferred	266,680	Convertible at \$2.12; anti-dilution rights
Warrants, Series F	7,760,400	EP \$2.12; Exp Nov. 2019-Nov. 2024
Warrants, Series F	265,816	EP \$4.50; Exp Nov. 2018-Nov. 2024
Warrants, all other	496,468	WAEP \$26.10; Exp Feb. 2022-Feb 2025
Options	1,987,502	WAEP \$4.90
RSUs	90	
Total	10,776,944	
Fully Diluted Shares	17,851,351	

Key Growth Opportunities Exist

Aquadex FlexFlow® Growth Drivers

1 **Established Customer Base**

Opportunity to expand utilization within our current customer base

2 **Underpenetrated Inpatient Market**

900,000 annual U.S. HF admissions for fluid overload, 68% achieving sub-optimal results with diuretics provide an inpatient opportunity of $\geq 600,000$ patients/year

3 **Untapped Outpatient Market**

Medicare penalties for early readmissions is driving a growing outpatient market with $\approx 300,000$ treatments per year in U.S. alone

4 **OUS Growth Opportunity**

OUS market largely untapped to date, offering long-term growth potential

5 **Multiple Clinical Applications**

Aquadex FlexFlow removes excess fluid in patients with a variety of fluid management issues

6 **Alignment with Market Dynamics**

Readmission rates and length of stay benefits of Aquadex FlexFlow are in line with the market shift toward value-based technology

7 **Dedicated Reimbursement Codes**

Producing clinical data and assimilating existing data can achieve dedicated outpatient codes and drive market uptake



For More Information

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