bluebird bio

August 2024

NASDAQ: BLUE

forward-looking statements

These slides and the accompanying oral presentation contain forward-looking statements and information. The use of words such as “may,” “might,” “will,” “should,” “expect,” “plan,” “anticipate,” “believe,” “estimate,” “project,” “intend,” “future,” “potential,” or “continue,” and other similar expressions are intended to identify forward-looking statements. For example, all statements we make regarding our expectations for our programs and therapies, including but not limited to our manufacturing and commercialization plans, including the number of anticipated patient starts across our portfolio of therapies, our expectations for expansion of the QTC network, patient demand for our therapies, and our ability to establish commercial infrastructure to support timely, equitable access to our therapies; our ability to establish favorable coverage for our therapies, including our ability to successfully partner with payers; our anticipated cash runway; and our expectations regarding our ability to access future tranches of our term loan facility, are forward looking. All forward-looking statements are based on estimates and assumptions by our management that, although we believe to be reasonable, are inherently uncertain. All forward-looking statements are subject to risks and uncertainties that may cause actual results to differ materially from those that we expected. These statements are also subject to a number of material risks and uncertainties that are described in our most recent annual Report on Form 10-K, as well as our subsequent filings with the Securities and Exchange Commission, including our Prospectus Supplement, dated December 19, 2023. Any forward-looking statement speaks only as of the date on which it was made. We undertake no obligation to publicly update or revise any forward-looking statement, whether as a result of new information, future events or otherwise, except as required by law.

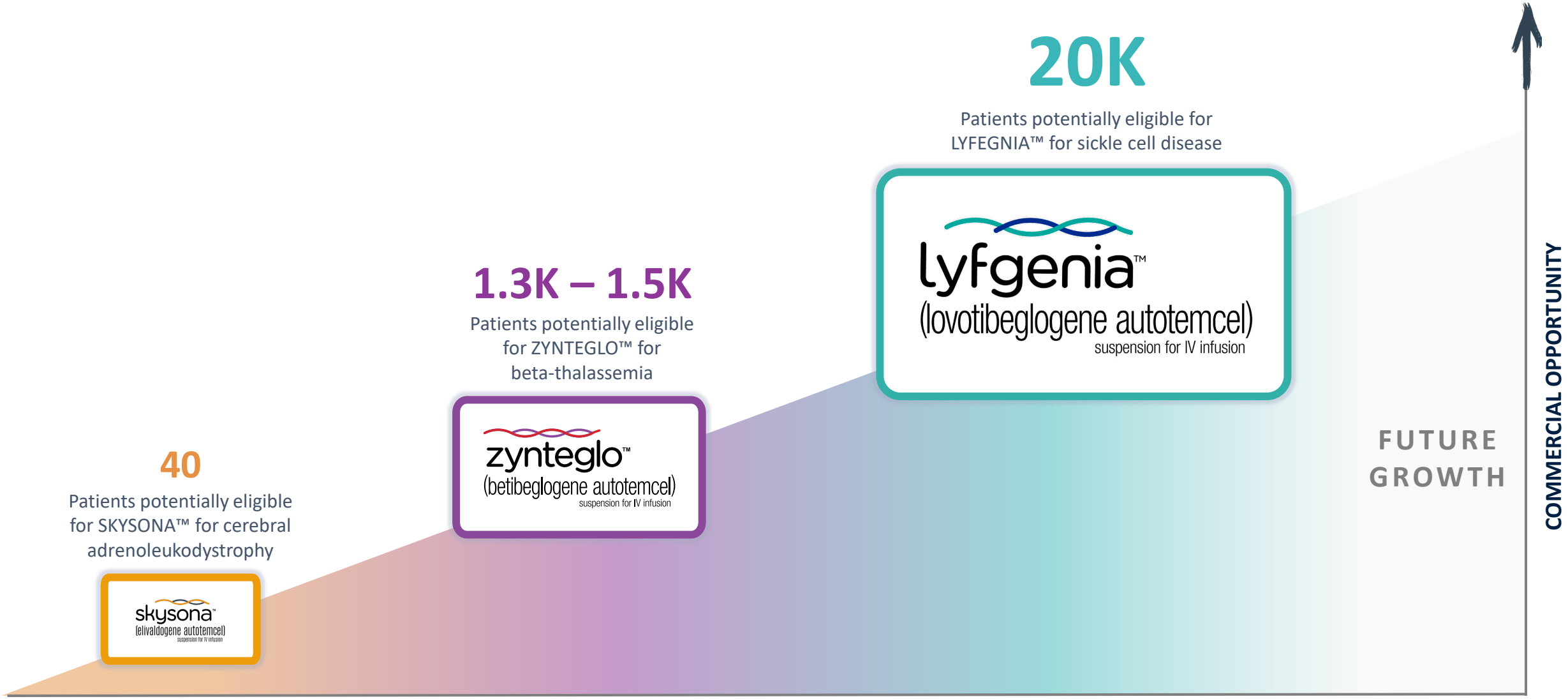
bluebirdbio

Pursuing Curative gene therapies ...

to give patients and their families more bluebird days

Only commercial gene therapy company with three FDA approved products

Momentum building with commercial launches; opportunity to deliver significant value for patients and shareholders



Deploying a validated, commercial strategy for LYFGENIA – informed by our real-world experience with ZYNTEGLO

lyfgenia™ (lovotibeglogene autotemcel) suspension for IV infusion

QTC network

- Over 70 QTCs activated[1]
- 4 patient starts complete

Access & Reimbursement

- >200 million lives covered
- Outcomes-based agreements signed with largest national payers
- Multiple Medicaid agencies have affirmed coverage criteria or approved prior authorization

Patient & Provider Experience

- Unparalleled follow up in clinical trials
- Safety profile well-understood
- Differentiated attributes that matter to patients, payers and providers

zynteglo™ (betibeglogene autotemcel) suspension for IV infusion

QTC network

- Over 70 QTCs activated[1]
- 39 patient starts since launch[2]
- Trusted relationships

Access & Reimbursement

- ~200 million lives covered including multiple state Medicaid agencies
- Zero ultimate denials across commercial or government payers to date

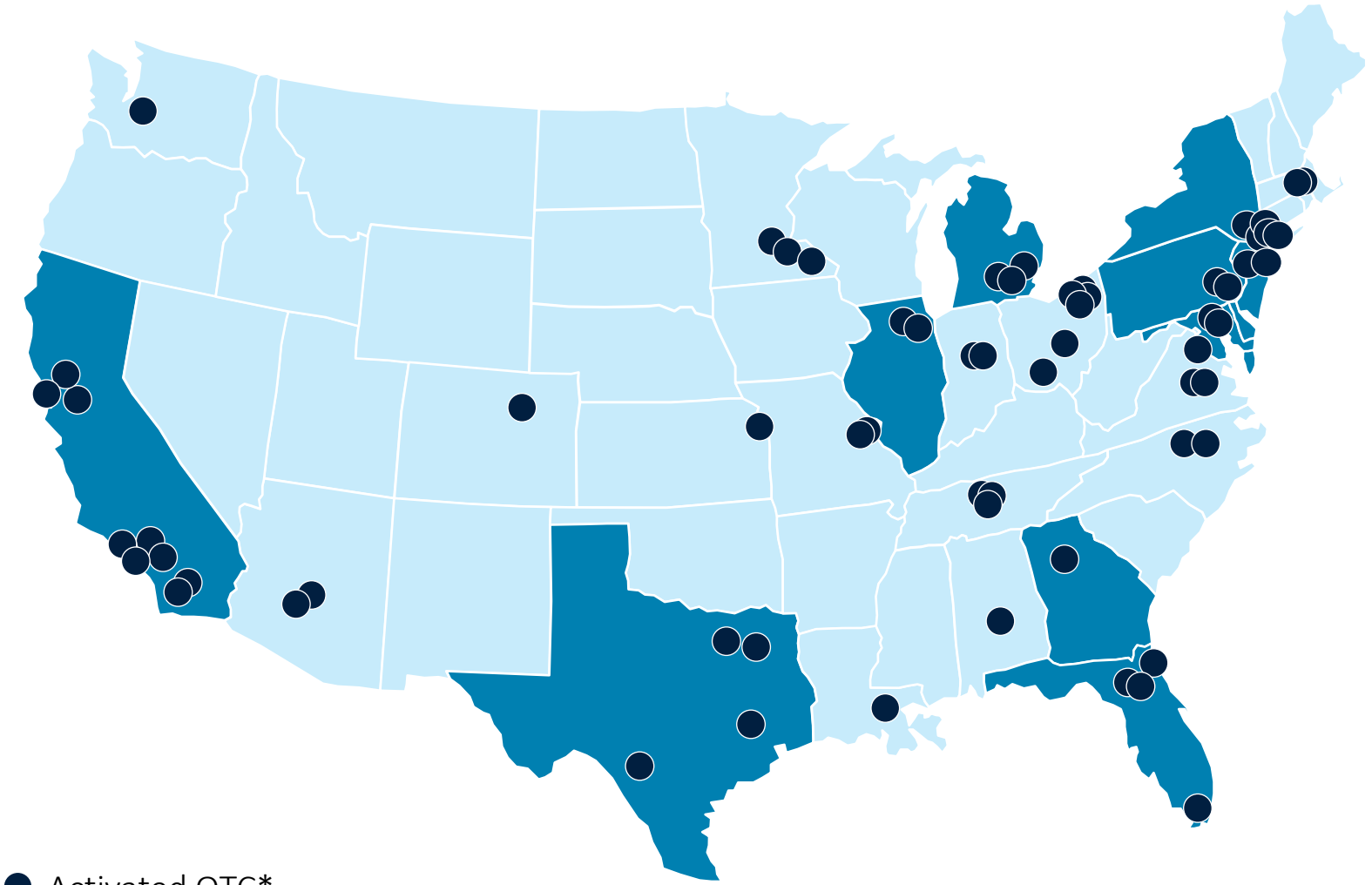
Patient & Provider Experience

- Clinical data well understood with >9 years of follow up for some patients
- Familiarity with commercial process
- Recognized gene therapy partner

1. Activated QTC defined as signed MSA 2. Patient starts as of August 14, 2024

QTC Network

Over 70 Qualified Treatment Centers (QTCs) activated; focus is on deepening experience with bluebird's gene therapy portfolio across the network



Patients receiving or scheduled for treatment **at more than 20 unique QTCs**

● Activated QTC*

■ Shading indicates target SCD market

*Activated QTC defined as signed MSA

Optimized QTC network designed to reach individuals living with SCD

STRONG DEMAND FOR GENE THERAPY

>70%

of SCD patients[1] would consider gene therapy if recommended by their doctor[2]

80%

of providers want both LYFEGNIA and its competitor available at their institution[3]

POISED TO MEET PATIENTS **WHERE** THEY ARE

95%

of SCD patients[1] are within 200 miles of a planned QTC[3]

88%

of target SCD patients are actively being treated in the healthcare system[4]

1. Potential addressable population of 20,000**;** 2. 70% figure supported by seven years of internal and external market research; 3. Data on file; 4. Komodo claims data

bluebirdbio®

Access & Reimbursement

Value of ZYNTEGLO is recognized

Patients with beta-thalassemia are **achieving access**

~200M
lives covered under contract or coverage policy

~90%
published coverage policies positive for ZYNTEGLO

ZERO
ultimate denials to date across commercial and government payers

Validated access and reimbursement strategy designed to enable timely, equitable access to LYFGENIA for sickle cell disease

$3.1M price tied to value

Demonstrated robust and sustained clinical benefit (out **more than 5** years)

Reflects lifetime impact of reducing or eliminating VOEs

- Healthcare utilization
- Future earnings
- Life opportunities

Outcomes-based agreement offerings

Meaningful risk sharing

Tied to VOE related hospitalizations

Patients followed for **3 years**

Commercial payer and Medicaid options designed to offer **predictability** and **operational ease**

Encouraging payer interactions

Signed outcomes-based agreements representing >200 million covered lives

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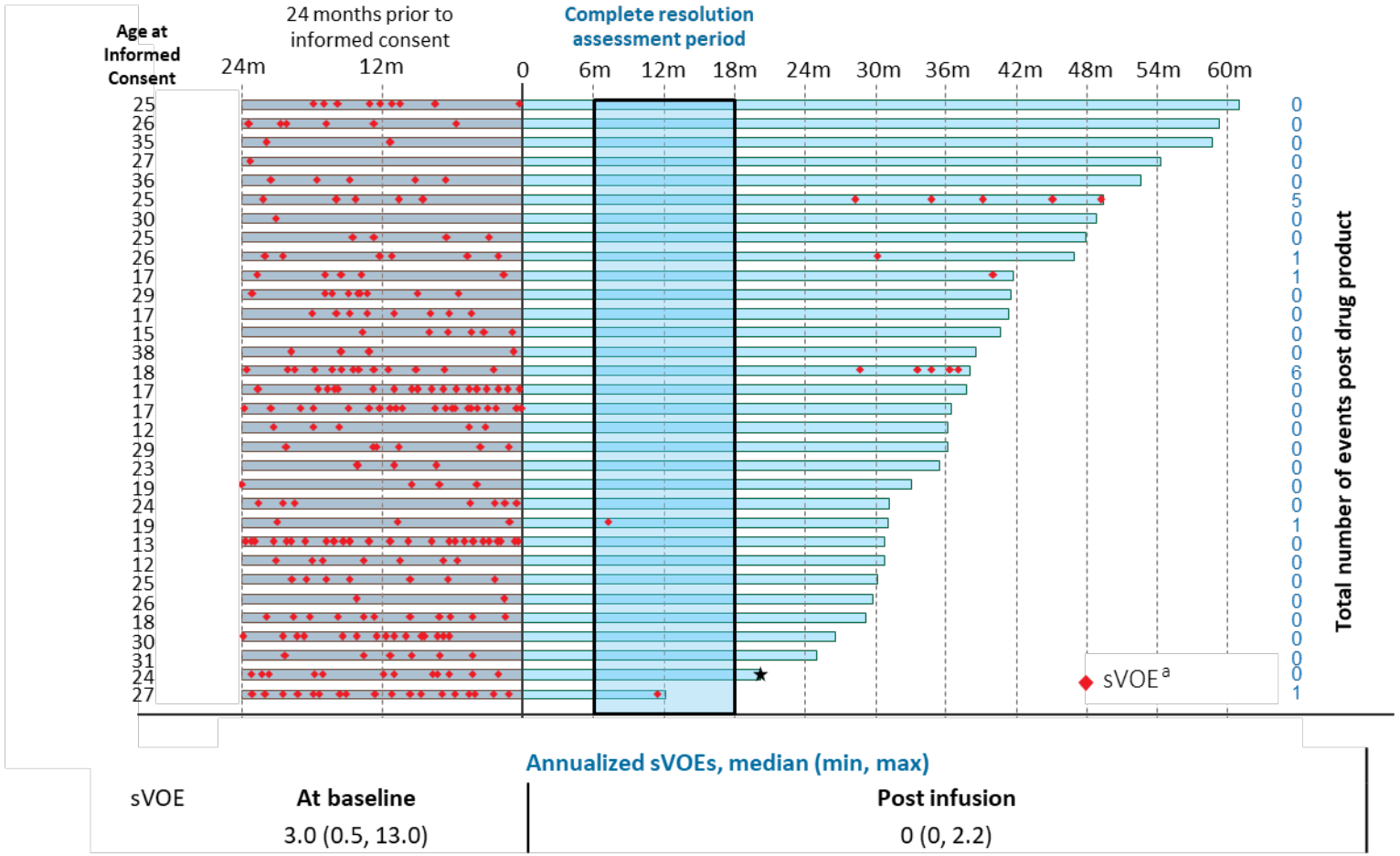
>1/2 of Medicaid insured individuals with SCD in the U.S. live in a state that has affirmed coverage for LYFGENIA

Nearly 20% of Medicaid-insured individuals with sickle cell disease live in a state that has completed prior authorization approval for LYFGENIA

Treatment Experience

LYFGENIA supported by the most robust and longest follow-up of any gene therapy program for SCD



★ Death, due to significant baseline SCD-related cardiopulmonary disease; not considered related to lovo-cel.

Data as of Feb 13, 2023

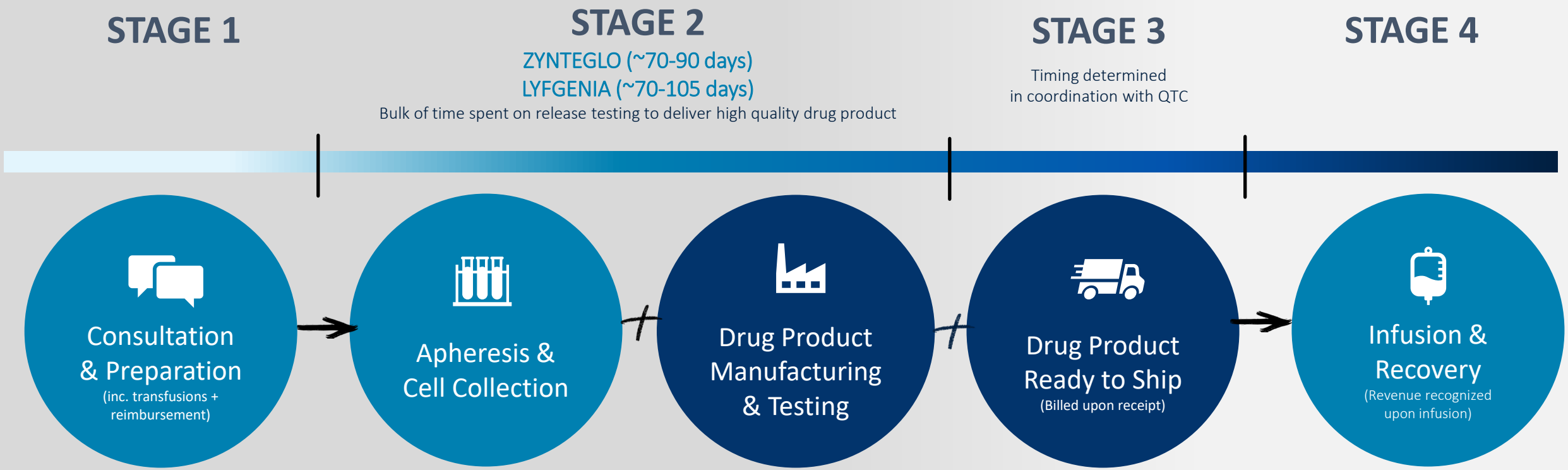
Clinical Data Supporting LYFGENIA

- Label based on efficacy data from 36 patients from HGB-206 Group C (median 38 months follow-up) and safety data from 54 patients*
- February 13, 2023 data cut showing:
  - 32 patients evaluable for VOE endpoints including 8 adolescent patients
  - 94% complete resolution of severe VOEs in the 6-18 months post infusion
  - 88% resolution of VOEs in the 6-18 months post infusion
  - Maintenance of VOE resolution in majority of patients through long-term follow up + stable production of HbA^{T87Q}
  - 100% of patients with history of stroke (n=5) remained free of recurrent stroke post-treatment with LYFGENIA
  - Majority of AEs attributed to underlying SCD or conditioning with busulfan
  - The label includes a Boxed Warning for hematologic malignancy

*54 patients initiated cell collection in HGB-206 Group A, Group B and Group C. [a] sVOE is defined as a VOE requiring a hospitalization or multiple visits to an emergency department/urgent care over 72 hours and receiving intravenous medications at each visit; all VOEs of priapism requiring any level of medical attention were also considered sVOEs

Delivering a consistent manufacturing process is essential for patients, families and providers

ZYNTEGLO™ and LYFGENIA™ use a similar manufacturing process with distinct supply chain and release criteria



Occurs at QTC Occurs at CMO

QTC: Qualified Treatment Center; CMO: Contract Manufacturing Organization. Stage 2 release time an estimate based on release criteria per product label

Differentiated attributes of LYFGENIA that matter to patients, payers and providers

Cell collections

In clinical trials, 85% required ≤2 cell collections for LYFGENIA[1]

Drug product delivery

Process is designed to take between 70-105 days from cell collection to drug product delivery to the QTC

Engraftment time

Median time to neutrophil engraftment 20 days, a key step to enabling patient discharge

Underpinned by clinical attributes – including >5 years of follow up, in-depth safety analyses, and data addressing SCD complications, including stroke

1. ASH 2023

Experienced commercial gene therapy team well-positioned to lead in hemoglobinopathies

1 **Potential multi-billion dollar opportunity**
with ~22,000 addressable patients in the US; established commercial strategy and projected patient and physician demand

2 **Significant commercial head start**
leveraging ZYNTEGLO launch synergies – same treating physicians, same QTCs, same payers

3 **Recognized gene therapy leader**
with deep gene therapy expertise, manufacturing experience and commercial infrastructure

bluebirdbio®

SKYSONA™

SKYSONA™ for cerebral adrenoleukodystrophy

skysona™
(elivaldogene autotemcel)
suspension for IV infusion

Commercial

- SKYSONA is indicated to slow the progression of neurologic dysfunction in boys 4-17 years of age with early, active cerebral adrenoleukodystrophy (CALD)
- 10 patient starts since launch*; 6 QTCs activated; zero ultimate denials across government and commercial payers

Clinical

- 67 patients treated across all clinical trials
- Accelerated approval based on post-hoc analysis of 11 patients; estimated 72% likelihood of major functional disability free survival at 24 months
- Multiple boys treated with SKYSONA have developed hematologic malignancy and the label includes a boxed warning.**

Patient starts is defined as a cell collection (apheresis); Activated QTC defined as Qualified Treatment Center with a signed MSA. *Patient starts as of August 14, 2024
**The Product label, including the boxed warning, was updated in April 2024 to include updated information on hematologic malignancies diagnosed in our clinical study patients as well as other updates to monitoring procedures and alternative treatment options. bluebird closely monitors potential and diagnosed cases of hematologic malignancy in patients treated with SKYSONA and additional cases are expected to arise over time. bluebird is communicating regularly with treating physicians and regulatory authorities including with respect to continued data analysis of trends and potential causes of such malignancies.

Closing

Established gene therapy leader poised to deliver shareholder value

Established Clinical Leadership

- 10+ years of gene therapy research
- 200+ patients treated
- 8 clinical trials
- 1,000 patient years of experience

Demonstrated Regulatory Success

- Established track record for LVV platform
- 3 FDA-approved gene therapies

Commercial Gene Therapy Leader

- Scaled for 3 commercial launches
- Synergistic transplant and cell therapy infrastructure
- Proven reimbursement

~85 patient starts[1] combined across LYFGENIA, ZYNTEGLO and SKYSONA anticipated in 2024

Current Financial Position

$193M unaudited cash, cash equivalents & restricted cash balance as of June 30, 2024[2]

Up to $50M in debt financing we may be eligible to receive in 2025

Cash runway into Q2 2025[3]

1. Patient start defined as unique cell collection; 2. Cash balance contains $49 million in restricted cash; 3. Cash runway is based on our current operating assumptions and is calculated using cash and cash equivalents (excluding restricted cash) as of June 30, 2024. Cash runway into Q2 2025 does not account for the cash minimums required under our loan agreement. Taking into account the required cash minimums, we expect our cash runway to extend into Q1 2025.

bluebird occupies a unique strategic position as a standalone gene therapy company

- 10+ years of gene therapy research
- 200 patients treated
- 8 clinical trials

Clinical & pre-clinical companies

- Established track record for LVV platform
- 3 FDA approvals

- 3 commercial launches
- Transplant and cell therapy infrastructure
- Proven reimbursement

Large cap pharma

thank you