



Diabetes Management at the Point-of-Care

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Opinions expressed in this presentation are those of the speaker and do not express the views or opinions of Cardinal Health

LEARNING OBJECTIVES

Discuss the current situation in terms of diabetes prevalence now and looking towards the future.

Examine current guidelines and goals surrounding diabetes diagnosis and management and the challenges associated with achieving them.

Review how point of care testing may improve operational efficiencies and lead to better outcomes.

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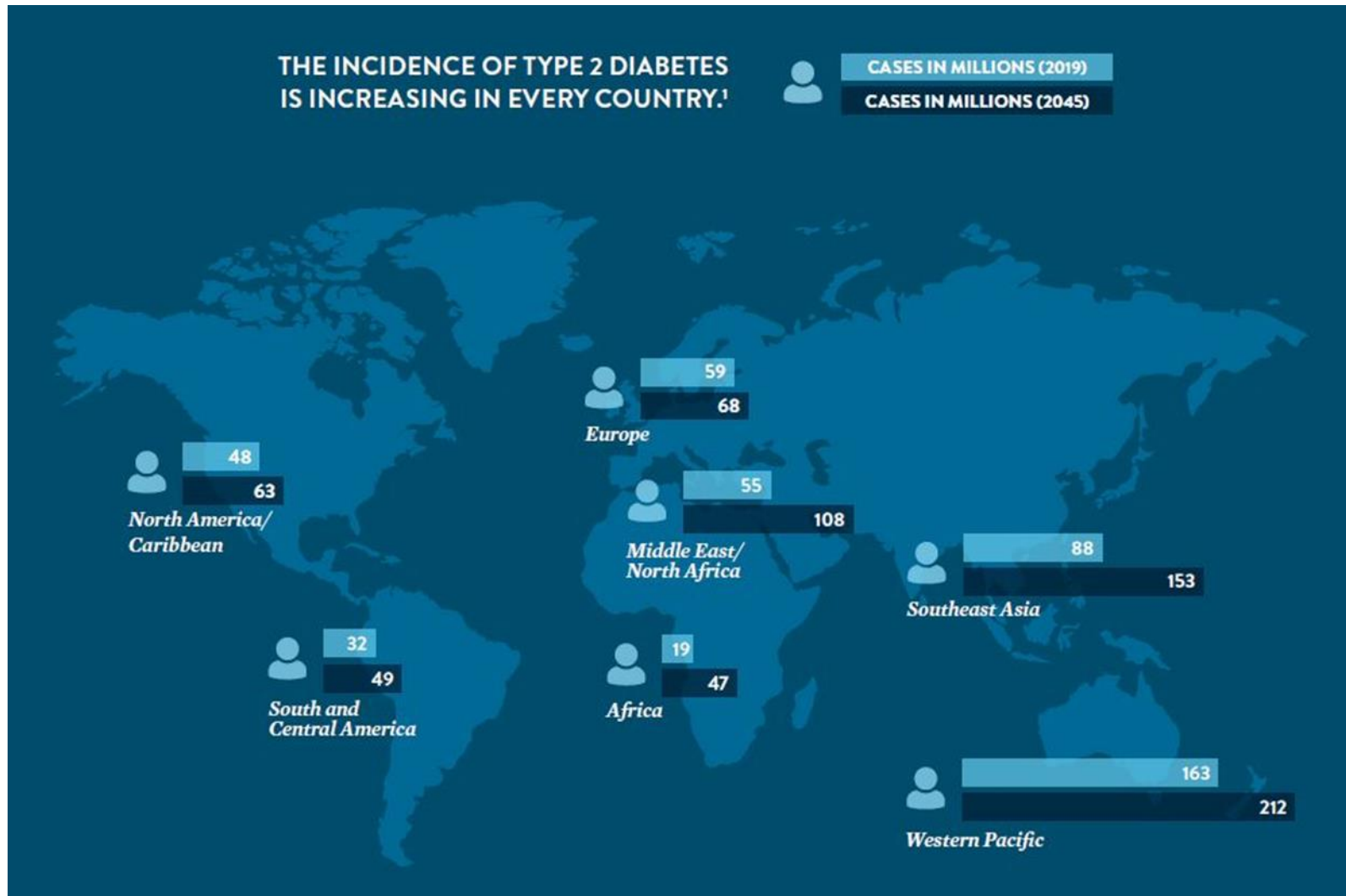
5 Advantages of Point-of-Care for Screening

6 Better Results in Diabetes Care

An Epidemic: The Shape of Things to Come



Diabetes Incidence in 2017 Estimated Projections for 2045



Adapted from: International Diabetes Federation. *IDF Diabetes Atlas, 9th edn. 2019*. Brussels, Belgium: <http://www.diabetesatlas.org>.

Startling Statistics and Projections

Diabetes Data Survey 2000 – 2045

| At a glance | 2000 | 2011 | 2021 | 2030 | 2045 |
|--|-----------|-----------|-----------|-----------|-----------|
| Diabetes estimates (20-79 y) | | | | | |
| People with diabetes, in 1,000s | 151,000.0 | 366,000.0 | 536,600.0 | 642,800.0 | 783,700.0 |
| Age-adjusted comparative prevalence of diabetes, % | 4.6 | 8.5 | 9.8 | 10.8 | 11.2 |

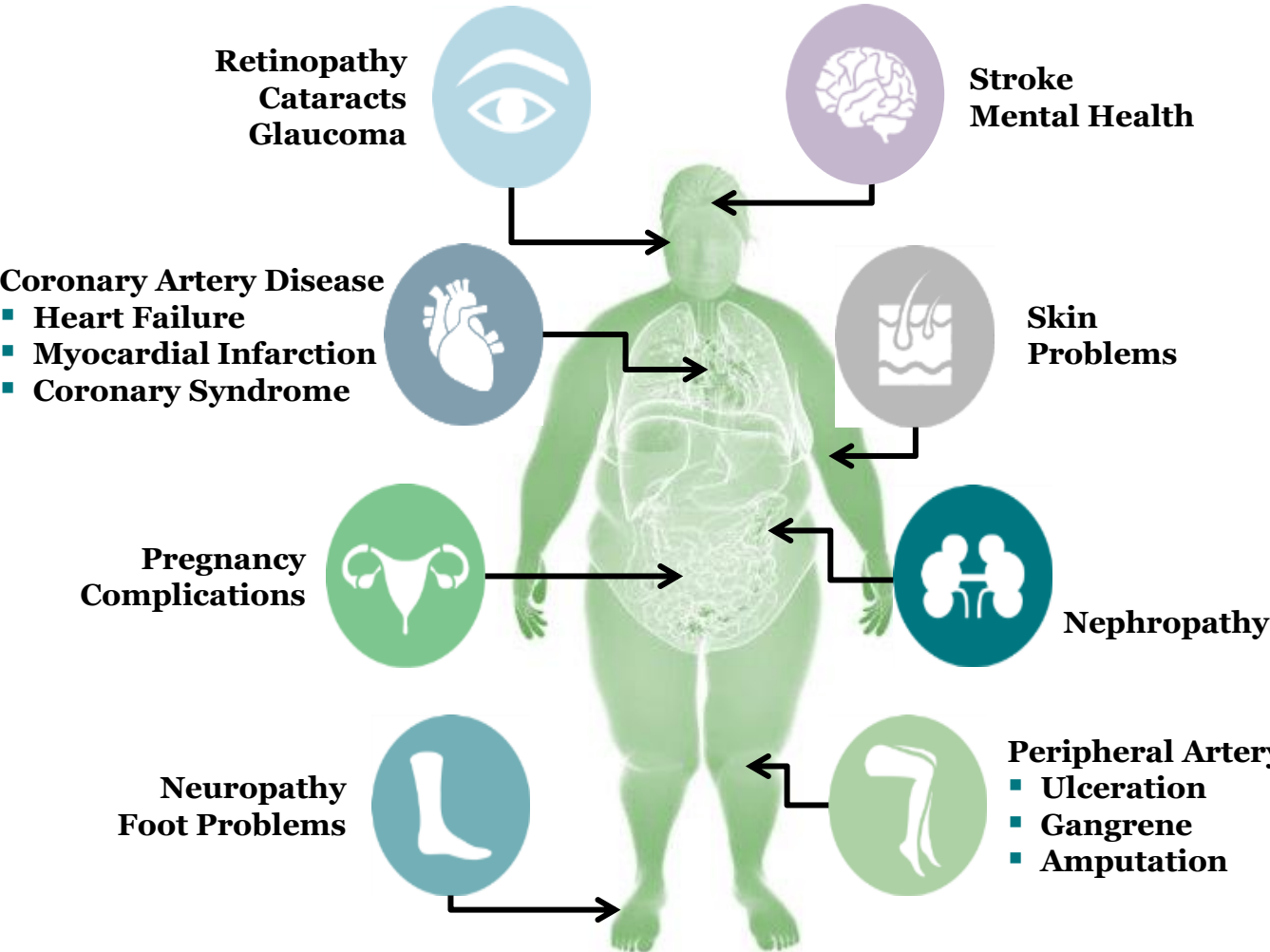
Estimated in 2017

536,600.0
9.8
483 M

783,700.0
11.2
700 M



What Lies Beneath: Complications of Diabetes



Annual global health expenditure on diabetes is estimated to be USD 760 billion. It is projected that expenditure will reach USD 825 billion by 2030 and USD 845 billion by 2045.

Data sourced from: American Diabetes Association. Living With Diabetes: Complications. 2015. Fowler MJ. *Clin Diabetes*. 2008;26:77-82
International Diabetes Federation. *IDF Diabetes Atlas, 9th edn*. 2019. <http://www.diabetesatlas.org>.
www.cdc.gov/media/pressrel/2010/r101022.html

Guidelines & Goals



What are the Current Guideline Targets for Screening and Diagnosis for Type 2 Diabetes?

| | ADA ¹ | ESC/EASD ² | IDF ³ |
|---------------------|---|---|--|
| | <ul style="list-style-type: none"> • Children, adolescents and adults of any age, overweight or obese, plus one or more additional risk factors • Testing should begin at age 45 • If test is normal, repeat it at least every 3 years | <ul style="list-style-type: none"> • General population and people with assumed abnormalities • Start with a risk score (e.g. FINDRISC) • For CVD patients, no diabetes risk score is needed | <ul style="list-style-type: none"> • Screen high-risk individuals: (>40-45 years, obese, increased circumference, hypertension, family history) • Start with a risk score (e.g. FINDRISK) • If normal, repeat it at least every 3 years; if positive, proceed with diagnostic test |
| Tests | <ul style="list-style-type: none"> • FPG • or 2-hr PG after 75-g OGTT criteria • or HbA1c | <ul style="list-style-type: none"> • OGTT • or combination of HbA1c and FPG | <ul style="list-style-type: none"> • FPG • or 2-hr PG after 75-g glucose load • or random plasma glucose in symptomatic patient • or HbA1c (a standardized HbA1c test should be available in every primary care clinic) |
| Pre-diabetes | HbA1c ≥ 5.7%-6.4% (39-46 mmol/mol)* | refer to WHO and ADA: HbA1c ≥ 6.5% (48 mmol/mol)* | HbA _{1c} ≥ 6.5% (48 mmol/mol)* |
| Diabetes | HbA1c ≥ 6.5% (48 mmol/mol)* | HbA1c ≥ 6.5% (48 mmol/mol)* | HbA1c ≥ 6.5% (48 mmol/mol)* |

*Values not recommended for children and adolescents

¹ADA. American Diabetes Association. Standards of Medical Care in Diabetes – 2020. Diabetes Care. 2020;43:Supplement 1.-2020

²ESC, EASD 2013. Guidelines on diabetes, prediabetes, and CV diseases

³IDF 2017. Clinical Practice Recommendations for managing T2D in Primary Care

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| Tests | <ul style="list-style-type: none"> • FPG • or 2-hr PG after 75-g OGTT criteria • or HbA1c | <ul style="list-style-type: none"> • OGTT • or combination of HbA1c and FPG | <p>Consider HbA1c as a diagnostic test, particularly in those who are very likely to have the disease, since it will also be necessary to decide treatment and monitor its effectiveness.</p> |
| Pre-diabetes | HbA1c ≥ 5.7%-6.4% (39-46 mmol/mol)* | refer to WHO and ADA: HbA1c ≥ 6.5% (48 mmol/mol)* | HbA _{1c} ≥ 6.5% (48 mmol/mol)* |
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³IDF 2017. Clinical Practice Recommendations for managing T2D in Primary Care

What are the Current Guidelines for Testing Frequency in a Comprehensive Diabetes Evaluation?

American Diabetes Association

| | |
|--|--|
| Hemoglobin A1c (HbA1c) | <ul style="list-style-type: none"> • 2-3 times per year in stable glycemic control |
| | <ul style="list-style-type: none"> • Quarterly in patients who have recently changed medications or who are not meeting glycemic goals |
| | <ul style="list-style-type: none"> • Use of point-of-care testing (POCT) for HbA1c provides the opportunity for more timely treatment changes |
| Albumin: creatinine ratio | <ul style="list-style-type: none"> • > 1 time/year, 3 in 6 months to confirm, more for monitoring changes in therapy |
| Fasting lipid panel | <ul style="list-style-type: none"> • At diagnosis, to monitor therapy adherence, and annually |
| Liver function tests | <ul style="list-style-type: none"> • At diagnosis and annually |
| Serum creatinine and calculated glomerular filtration rate | <ul style="list-style-type: none"> • At diagnosis |
| Blood pressure (BP) | <ul style="list-style-type: none"> • Every routine visit |

Data sourced from: American Diabetes Association. Standards of Medical Care in Diabetes – 2020. Diabetes Care. 2020;43:Supplement 1.

What are the Current Guideline Targets for Monitoring a Patient With Diabetes?

| Test | ADA ¹ | ESC/EASD ^{2,3} | IDF ⁴ |
|-------|--|--|--|
| HbA1c | <ul style="list-style-type: none"> • Point-of-care • 3-6 months • < 7% | <ul style="list-style-type: none"> • < 7% (53 mmol/mol) • Individual < 6.5-6.9% (48-52 mmol/mol) | <ul style="list-style-type: none"> • Every 2-6 months • < 7% (53 mmol/mol) |
| LDL | <ul style="list-style-type: none"> • At diagnosis and annually • < 100 mg/dL | <ul style="list-style-type: none"> • < 100 mg/dL high risk (2.5 mmol/L) • < 70 mg/dL very high risk (1.8 mmol/L) | <ul style="list-style-type: none"> • At diagnosis and annually • < 70 mg/dL high risk (1.8 mmol/L) |
| ACR | <ul style="list-style-type: none"> • At least annually • < 30 mg/g | <ul style="list-style-type: none"> • < 30-300 mg/g (< 3.4-34 mg/mmol) | <ul style="list-style-type: none"> • At diagnosis and every 1-2 years • < 30 mg/g |
| BP | <ul style="list-style-type: none"> • Every visit | <ul style="list-style-type: none"> • < 140 mmHg | <ul style="list-style-type: none"> • At least annually and every routine visit if patient has CVD or is on associated medication • < 130 to 140/80 mmHg |

¹ADA. American Diabetes Association. Standards of Medical Care in Diabetes. *Diabetes Care*. 2020;43(Suppl. 1):S66-S76.2016;39(suppl 1):S1-S106

²Rydén L, Grant PJ, Anker SD, et al. ESC Guidelines on diabetes, pre-diabetes, and cardiovascular diseases developed in collaboration with the EASD: the Task Force on diabetes, pre-diabetes, and cardiovascular diseases of the European Society of Cardiology (ESC) and developed in collaboration with the European Association for the Study of Diabetes (EASD). *Eur Heart J*. 2013;34(39):3035-3087.

³Mancia G, Fagard R, Narkiewicz K, et al. 2013 ESH/ESC Guidelines for the management of arterial hypertension. The Task Force for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). *J Hypertens*. 2013;31(7):1281-1357.

⁴IDF Clinical Practice Recommendations for managing Type 2 Diabetes in Primary Care, International Diabetes Federation – 2017. International Diabetes Federation. <https://www.idf.org/e-library/guidelines/128-idf-clinical-practice-recommendations-for-managing-type-2-diabetes-in-primary-care.html>. Accessed January 3, 2020.

Compliance With Guideline Targets is Poor

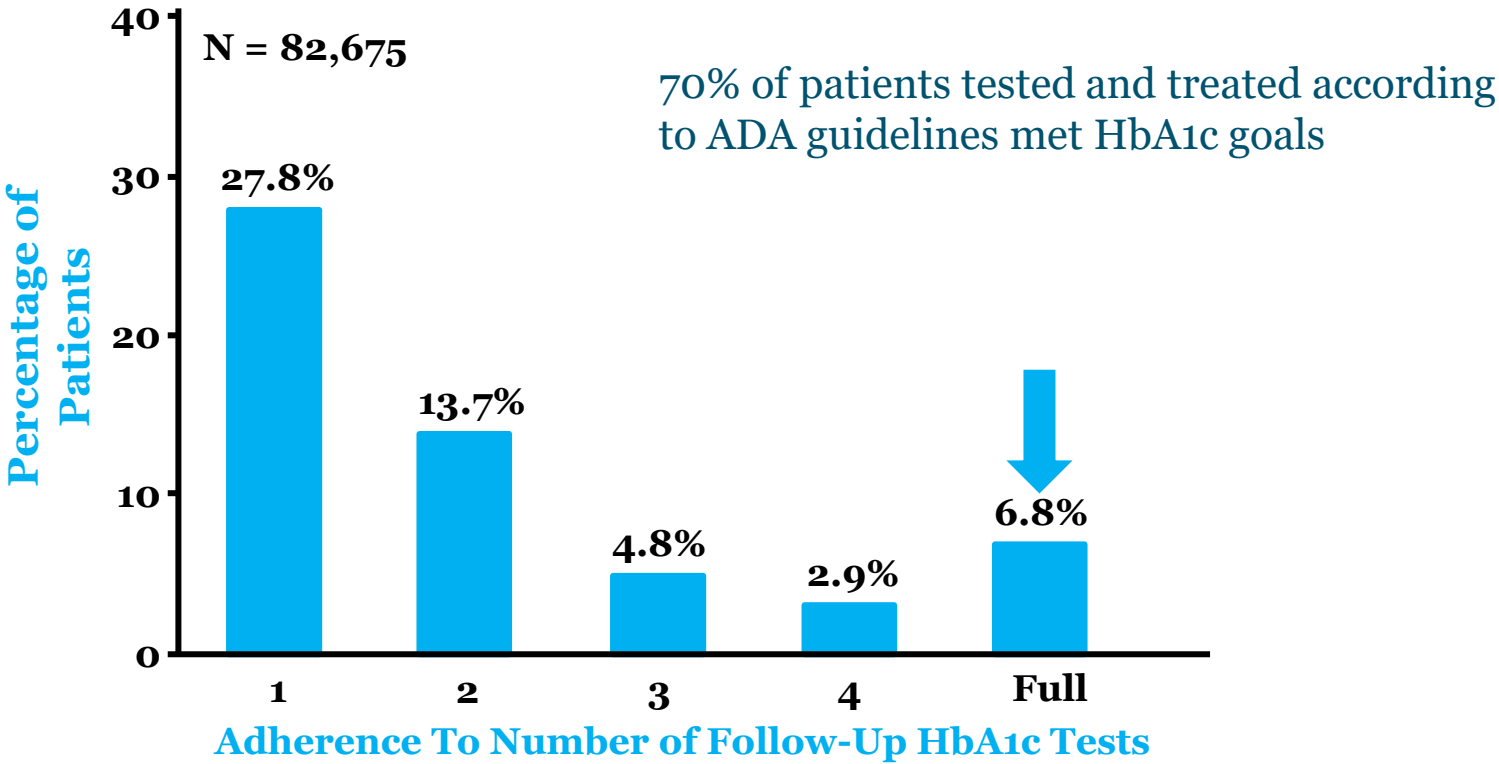
Only 26.7% of patients diagnosed with diabetes meet targets for glycemic, blood pressure, or cholesterol control



Ali MK, Bullard KM, Gregg EW, del Rio C. *Ann Intern Med.* 2014;161(10):681-9.

Diabetes Patients with Less than 7% HbA1c Are Tested at the Guideline Recommended Frequency

Patients managed in compliance with HbA1c testing frequency guidelines alone, and those managed in compliance with antidiabetic treatment & HbA1C testing frequency guidelines were 2.43 & 5.29 times more likely to achieve HbA1c < 7% respectively than those who didn't follow the guidance (P < 0.0001).



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Only 3% of Patients Are Tested and Treated According to Guidelines

- 3% of patients meet guidelines for HbA1c testing frequency AND guideline recommended antidiabetic treatment modification
- 70% of patients tested and treated according to ADA guidelines met HbA1c goals
 - Only 30% met HbA1c goals if they did not meet guidelines for either testing frequency or treatment modification

| Outcome | Did Not Meet Either Guideline (N = 1,297) | Met Both Guidelines (N = 40) | Total (N = 1,337) |
|-------------------------------------|---|------------------------------|-------------------|
| Did not achieve target HbA1c, n (%) | 900 (69.4) | 12 (30.0) | 912 (68.2) |
| Achieved target HbA1c, n (%) | 397 (30.6) | 28 (70.0) | 425 (31.8) |

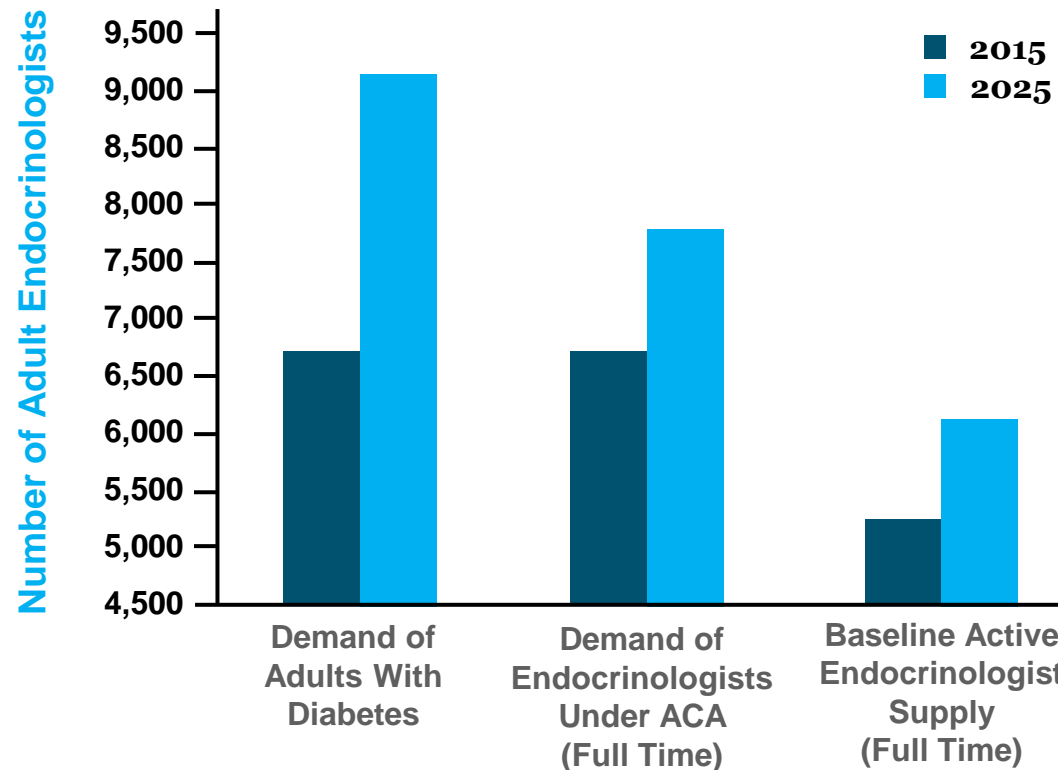
Permission granted through Creative Commons License:
Lian J, Lang Y. *Curr Med Res Opin.* 2014;30(11):2233-40.



Endocrinologists and Increased Demand

There are not enough endocrinologists to handle increasing number of people with diabetes

- Currently handle only 20% of diabetes cases vs. 80% by primary care

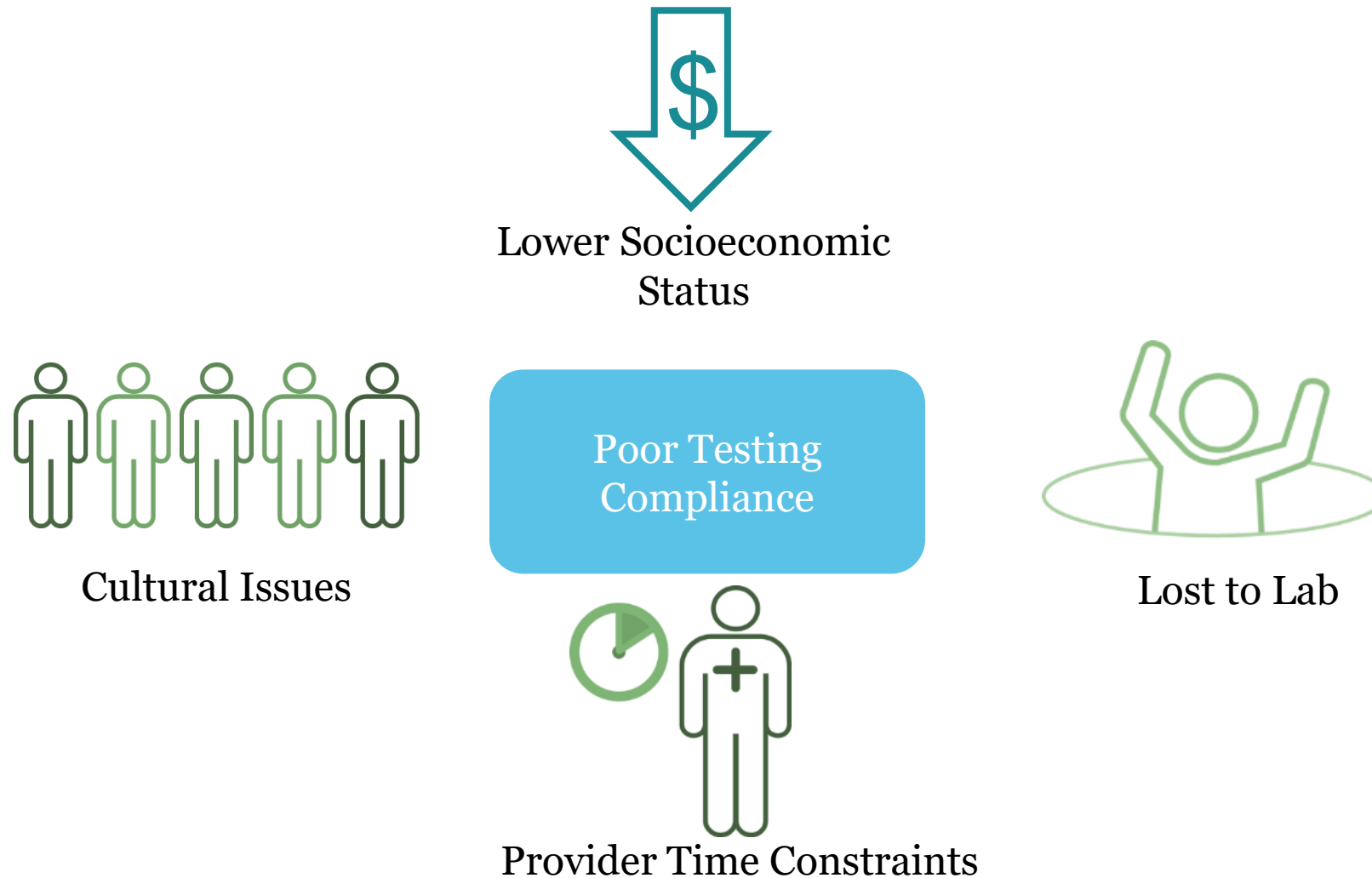


Saudek CD. *Clinical Diabetes*. 2002;20(2):65-6.

Adapted from: Endocrine Clinical Workforce: Supply and Demand Projections. *The Endocrine Society*. 2014.



Why is Testing Compliance Poor?



Currie CJ, Peyrot M, Morgan CLL, et al. *Diabetes Care*. 2012;35:1279–84.

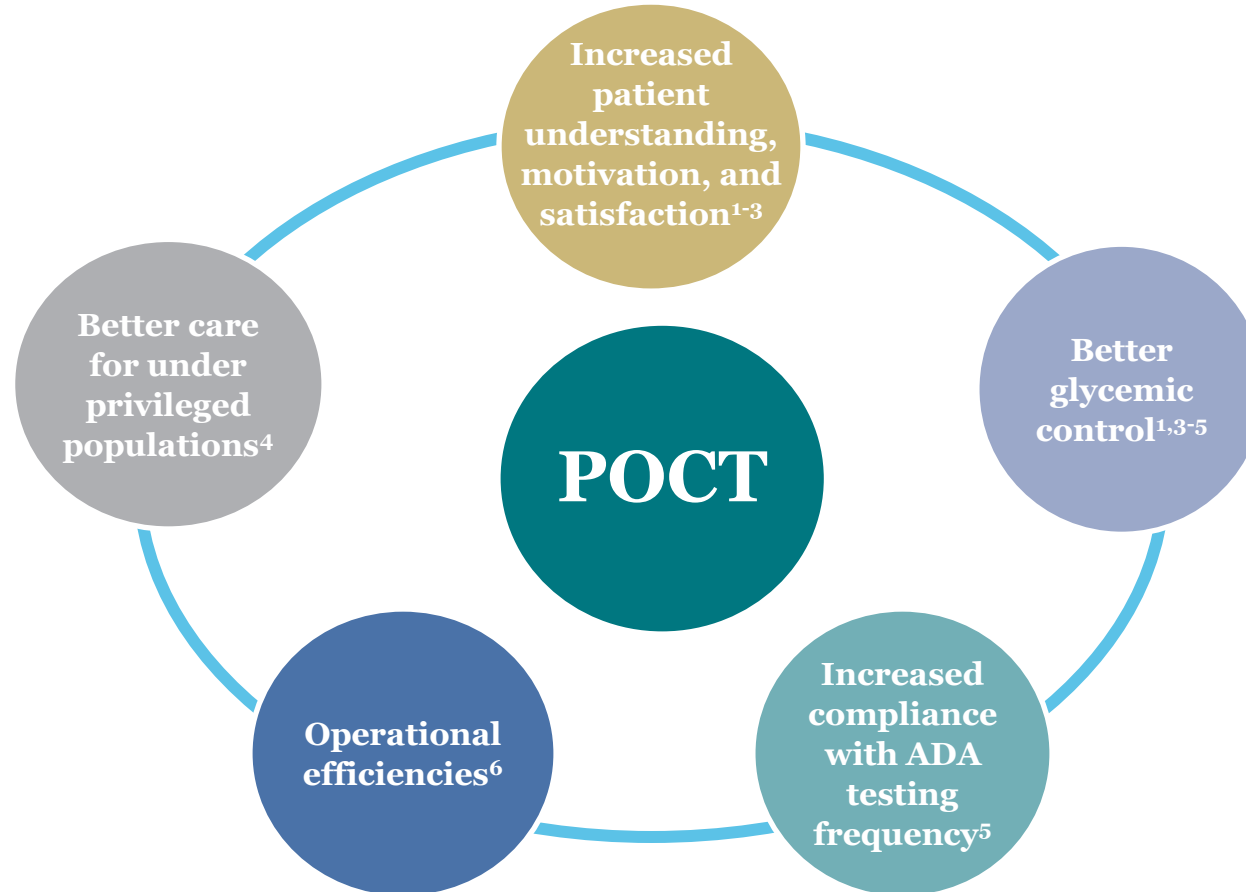
García-Pérez LE, Alvarez M, Dilla T, Gil-Guillén V, Orozco-Beltrán D. *Diabetes Ther*. 2013;4(2):175–94.

Advantages of Point-of-Care Testing



Can POC Testing Help?

Advantages Observed With POCT HbA1c vs. Lab for Monitoring Diabetes



¹Shepard MD. *Clin Biochem Rev.* 2006;27(3):161-70.

²Laurence CO, Gialamas A, Bubner T. *Br J Gen Pract.* 2010;60(572):e98-e104.

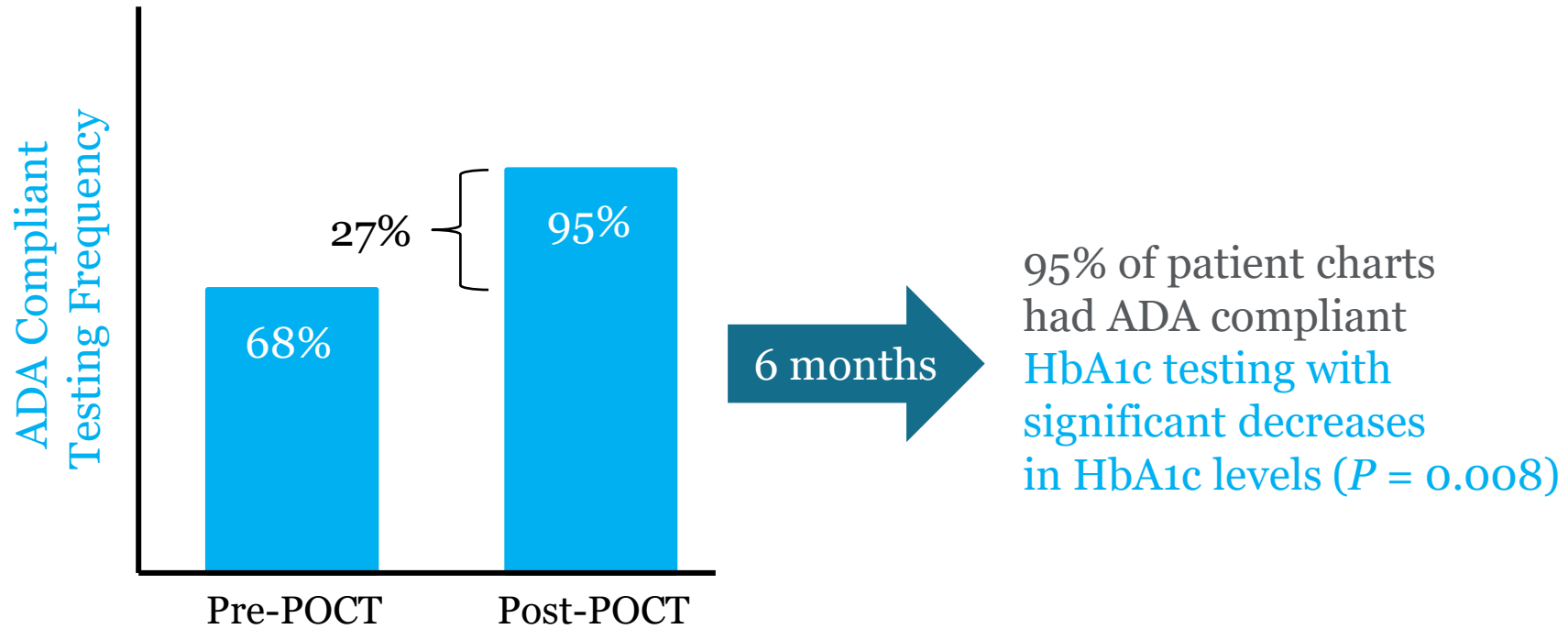
³Miller CD, Barnes CS, Phillips LS, et al. *Diabetes Care.* 2003;26(4):1158-63.

⁴Rust G, Gailor M, Daniels E, et al. *Int J Healthcare Qual Assurance.* 2008;21(3):325-35.

⁵Egbunike V, Gerard S. *Diabetes Educator.* 2013;39:66-73.

⁶Crocker JB, Lee-Lewandrowski E, Lewandroski N, et al. *Am J Clin Pathol.* 2014;142:640-6.

POC Testing: Increased Compliance With Testing Frequency and Reduced HbA1c

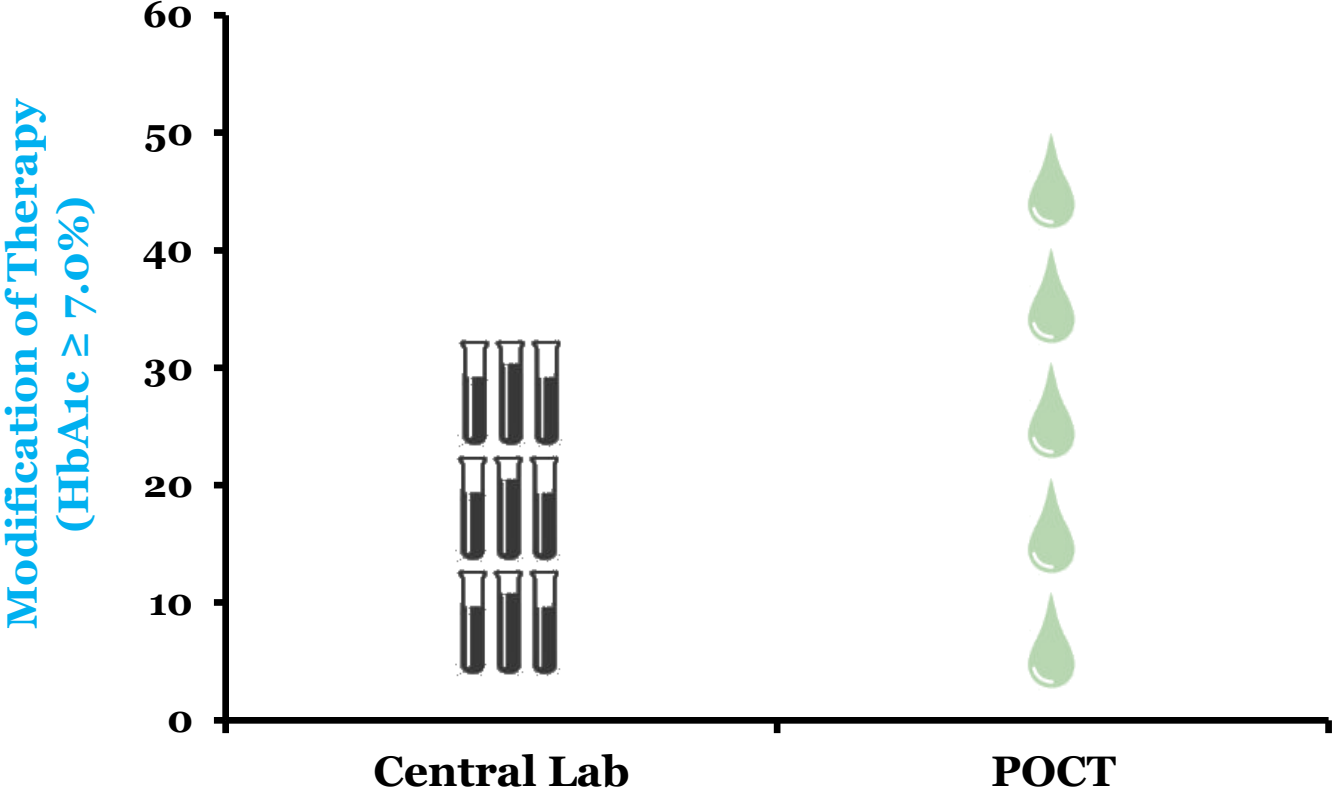


ADA-compliant testing frequency = decreased HbA1c levels.

Adapted from: Egbunike V, Gerard S. *Diabetes Educator*. 2013;39:66-73.

POC Testing: Increased Compliance With Testing Frequency and Reduced HbA1c

POCT HbA1c resulted in more frequent modification of therapy when HbA1c was $\geq 7.0\%$ compared to central lab (N = 597, P = 0.01)







Adapted from: Miller CD, Barnes CS, Phillips LS, et al. *Diabetes Care*. 2003;26(4):1158-63.



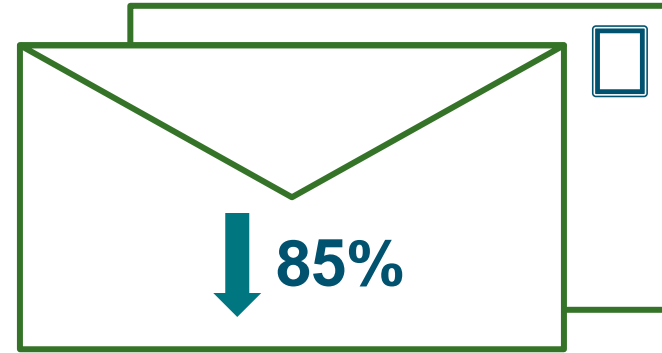
POC Testing: Increased Compliance With Testing Frequency and Reduced HbA1c

- HbA1c dropped significantly in the POCT group in follow-up (N = 275, P = 0.04)
- Follow-up appointment at 4 months.

| | Initial HbA1c | Follow-up HbA1c | P Value |
|-------------|--|--|---------|
| POCT | 8.4  | 8.1  | 0.04 |
| Central Lab | 8.1  | 8.0  | 0.31 |

Adapted from: Miller CD, Barnes CS, Phillips LS, et al. *Diabetes Care*. 2003;26(4):1158-63.

POC Testing Increases Practice Efficiency and Leads to Cost Reductions



With POCT

89% fewer follow-up phone calls

85% fewer follow-up letters

Cost savings from improved efficiency: **\$24.64 per patient**

Data sourced from: Crocker JB, Lee-Lewandrowski E, Lewandroski N, et al. *Am J Clin Pathol.* 2014;142:640-6.

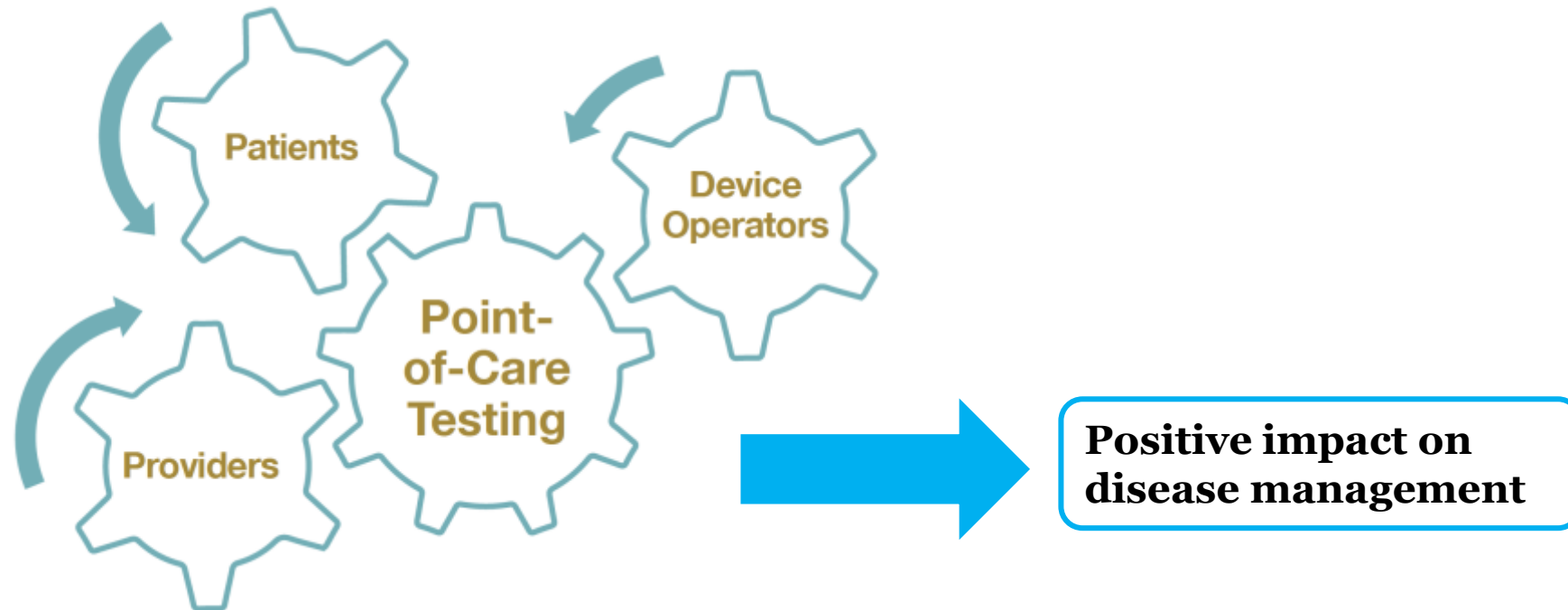
POC Testing Improves Patient Satisfaction

| Areas | Statements | POCT Intervention* | Central Lab Control* | P Value |
|---------------------------|---|--------------------|----------------------|---------|
| Collection process | I would rather have blood taken by a finger prick than by needle in my arm | 7.8 (0.92) | 5.1 (1.64) | < 0.001 |
| Confidence in the process | Laboratories have better hygiene than point-of-care testing | 4.3 (1.65) | 4.6 (2.07) | < 0.001 |
| Confidence in the results | I have confidence in the information given by my GP or practice regarding my pathology test result | 9.0 (0.06) | 8.9 (0.18) | 0.010 |
| Convenience | Not having to travel to an outside laboratory would be convenient | 8.9 (0.17) | 8.7 (0.36) | 0.009 |
| Cost | Outside pathology laboratories involves extra time and transport costs | 8.5 (0.44) | 8.6 (0.39) | 0.510 |
| Disease management | Having immediate feedback of the test result for my condition was important as it allowed/would allow me to discuss the management of my condition with my GP | 9.0 (0.12) | 8.7 (0.30) | 0.003 |
| | I am/would be more motivated to look after my condition because of regular point-of-care testing | 8.9 (0.29) | 8.2 (0.64) | < 0.001 |
| | Point-of-care testing strengthened/would strengthen my relationship with my GP | 8.3 (0.52) | 8.1 (0.72) | 0.010 |

A lower transformed score indicates a higher level of agreement except for the hypothesis relating to confidence in the process, where a higher transformed score indicates a higher level of agreement. *median satisfaction score (mean transformed satisfaction score)

POC Testing: Increased Overall Satisfaction

Patients, practitioners, and device operators all agreed that POCT increased satisfaction over central laboratory practices and results



Adapted from: Point-of-Care Testing in General Practice Final Report Jan 2009.
Laurence CO, Gialamas A, Bubner T. *Br J Gen Pract.* 2010;60(572): e98–e104.

HbA1c POCT Improves Glycemic Control, Appropriate Management, and Operational Efficiencies

| Study | Findings |
|------------------------------|--|
| Rust et al. ¹ | <ul style="list-style-type: none"> HbA1c testing frequency increased post-POCT implementation HbA1c levels decreased post-POCT implementation Interventions increased significantly in post-POCT implementation period |
| Thaler et al. ² | <ul style="list-style-type: none"> POCT HbA1c resulted in more appropriate management |
| Grieve et al. ³ | <ul style="list-style-type: none"> POCT HbA1c resulted in more appropriate management Patients were more satisfied with POCT HbA1c compared to conventional testing Patients were more likely to remember HbA1c levels if provided from POCT HbA1c levels were lower in POCT group than conventional lab group Patients tested with POCT had lower costs and number of visits |
| Shephard et al. ⁴ | <ul style="list-style-type: none"> HbA1c contributed positively to patient care, improved the doctor-patient relationship and improved compliance and self-motivation Post-POCT implementation — HbA1c levels decreased, there were fewer patients with poor control and a higher number achieved target HbA1c levels |
| Egbunike et al. ⁵ | <ul style="list-style-type: none"> POCT HbA1c improved operational efficiencies HbA1c testing frequency increased post-POCT implementation HbA1c levels decreased post-POCT implementation. |
| Miller et al. ⁶ | <ul style="list-style-type: none"> POCT HbA1c resulted in more appropriate management HbA1c levels decreased with POCT |

Data sourced from:

¹Rust G, Gailor M, Daniels E. *Int J Health Care Qual Assur.* 2008;21:325-35.

²Thaler LM, Dunbar VG, Ziemer DC, et al. *Diabetes Care.* 1999;22:1415-21.

³Grieve R, Beech R, Vincent J, Mazurkiewicz. *Health Technol Assess.* 1999;3:1281-357.

⁴Shephard MDS. *Health Technol Assess.* 1999;3:1281-357.

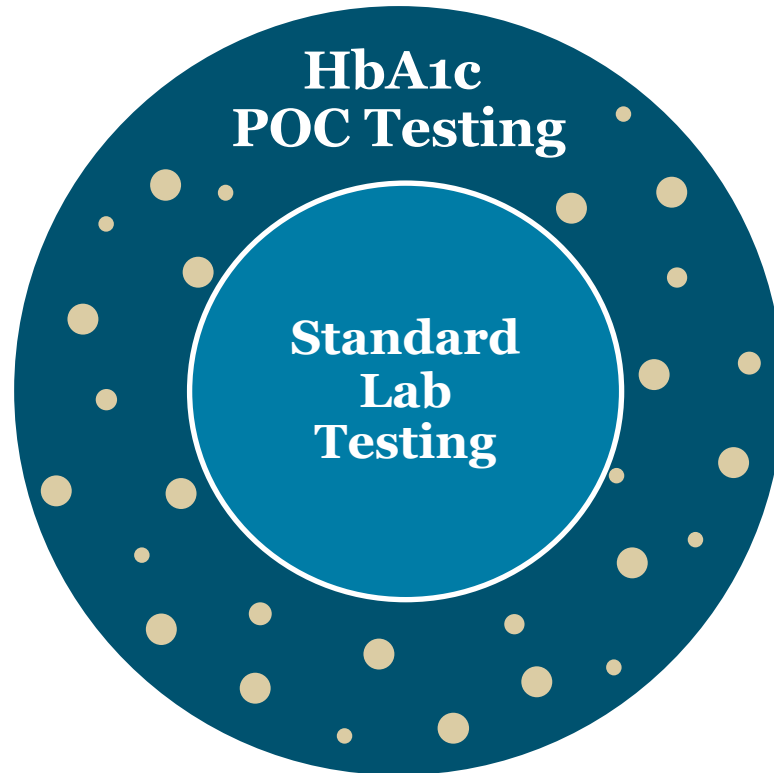
⁵Egbunike V, Gerard S. *Diabetes Educator.* 2013;39:66-73.

⁶Miller CD, Barnes CS, Phillips LS, et al. *Diabetes Care.* 2003;26(4):1158-63.

Advantages of Point-of-Care for Screening



HbA1c POC Tests Identify More Chronic Hyperglycemic Patients Than Blood Glucose Tests

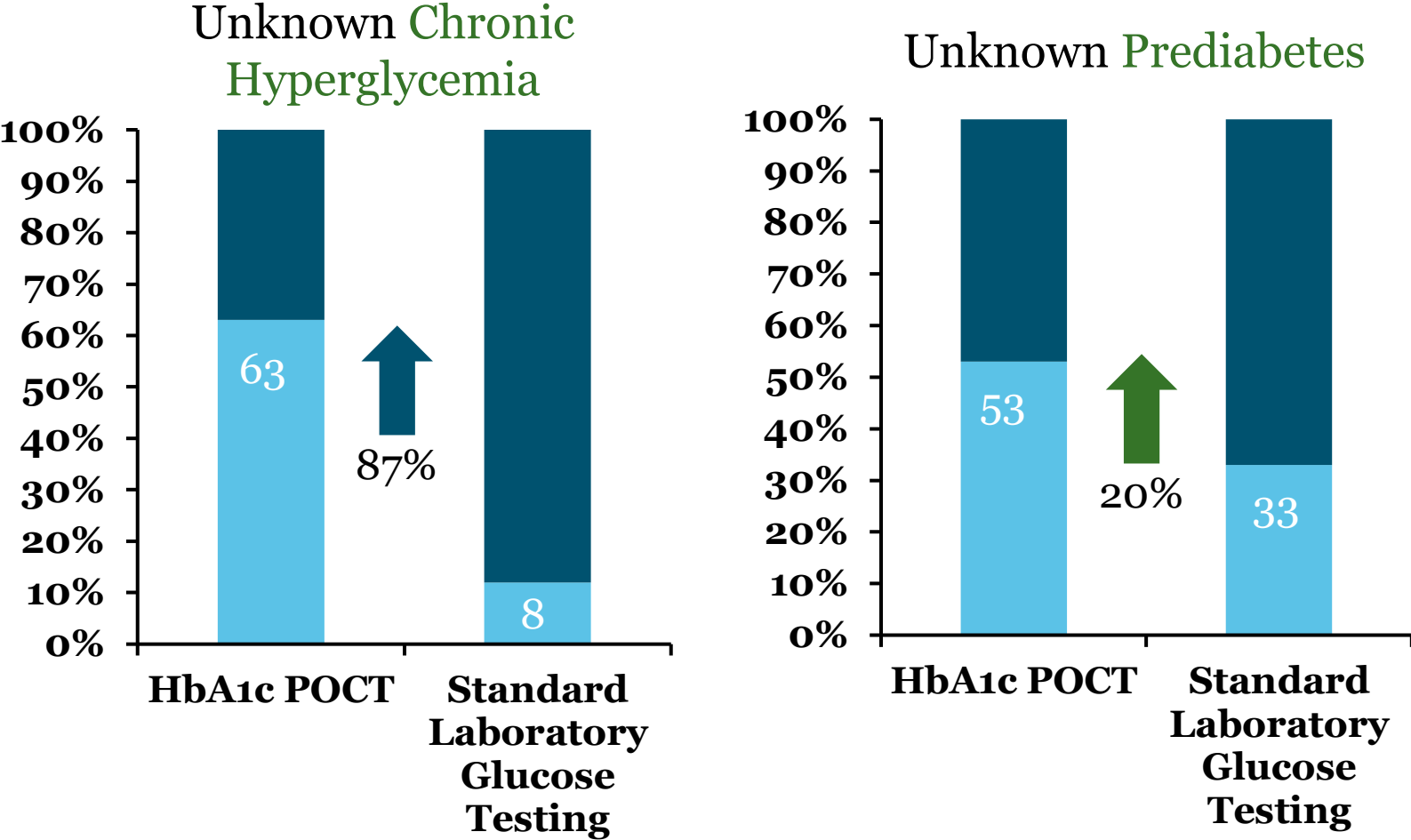


POC HbA1c tests **increase** the chance for diabetes screening to occur compared to standard practice ($P = 0.005$).

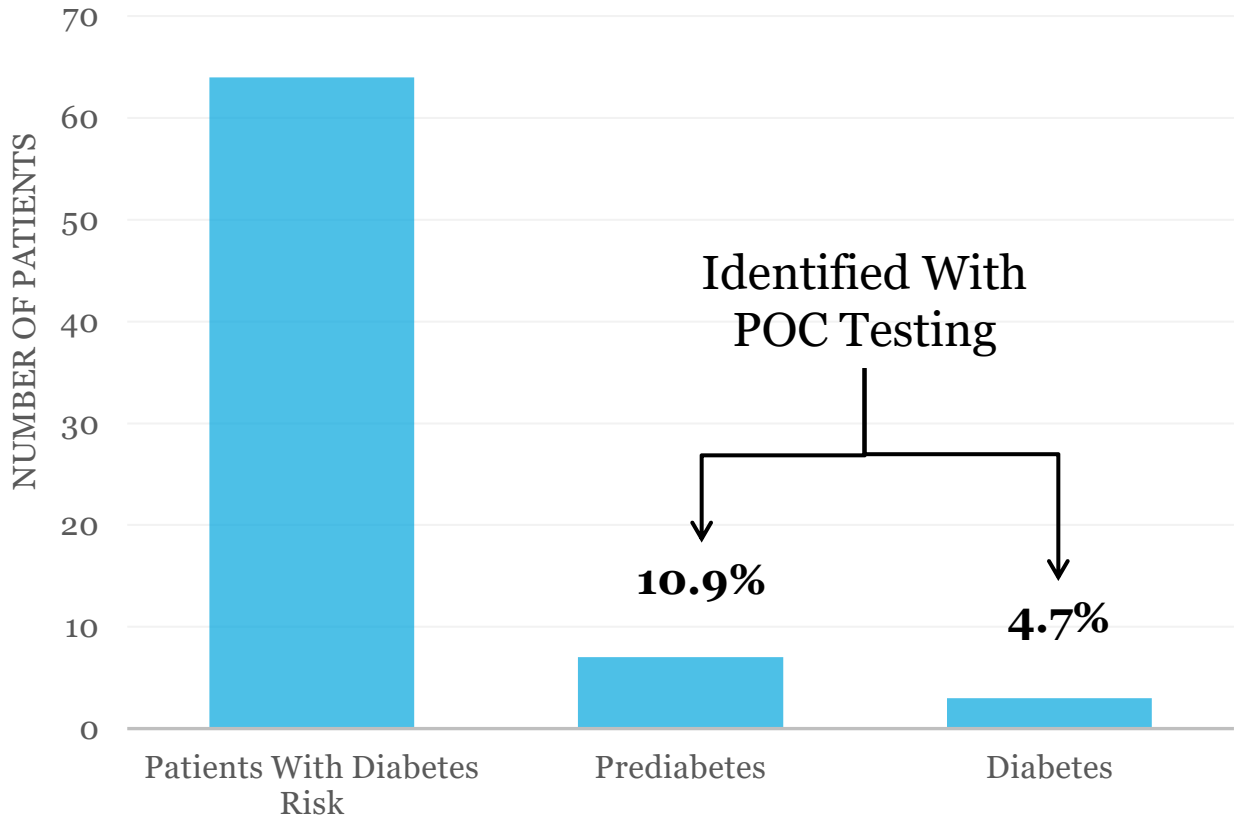
More screening leads to more identification
and less patients living with unknown uncontrolled diabetes.

Whitley HP, Hanson C, Parton JM. *Ann Fam Med*. 2017; 15:162-64.

HbA1c POC Tests Can Identify More Patients With Chronic Hyperglycemia and Prediabetes



POC Tests Improve Detection of Diabetes and Prediabetes in Urgent Care



Clark SR, Wilson ML. *J Urg Care Med*. October 2016.
<https://www.jucm.com/original-research-early-diabetes-screening-urgent-care-part-2/>. Accessed 10/3/17.



Urgent Care Staff and POC Testing Creates Compliance and Satisfaction

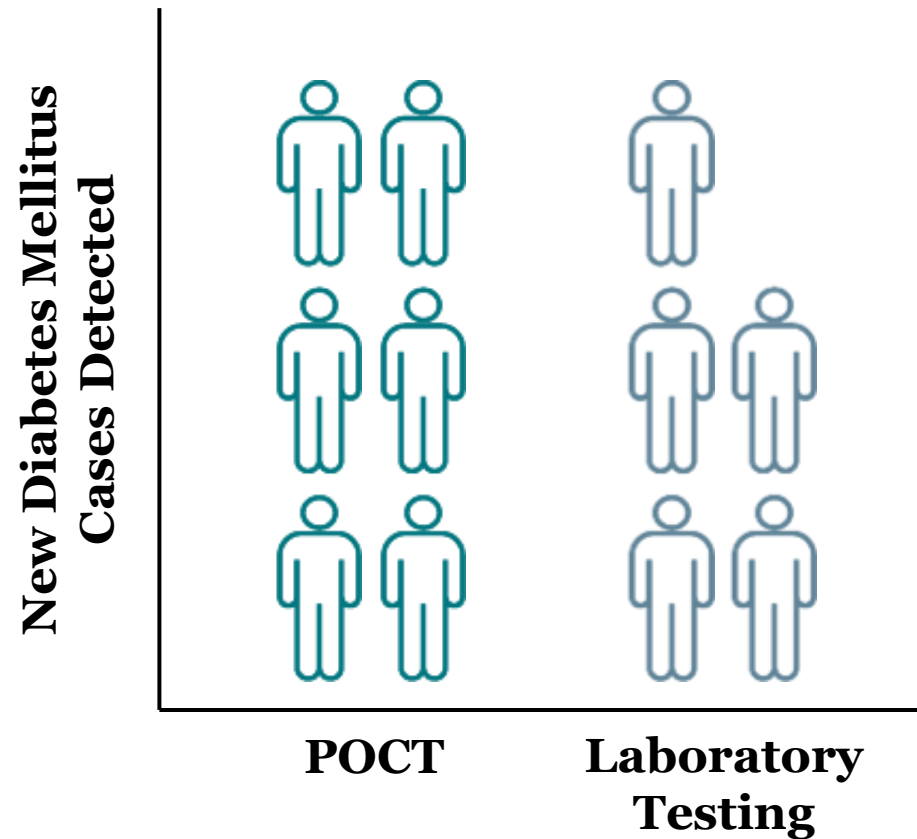
90.6%
Staff Compliance
With Screening Method



100%
Staff Satisfaction
With POC HbA1c Testing

Clark SR, Wilson ML. *J Urg Care Med*. October 2016.
<https://www.jucm.com/original-research-early-diabetes-screening-urgent-care-part-2/>. Accessed 10/3/17.

POC HbA1c Identifies Similar Numbers of New Diabetes Cases as Conventional HbA1c Testing



POC HbA1c testing is **useful for diabetes screening** in the community when confirmed by standard laboratory testing.

Better Results in Diabetes Care



Conclusions

- Increased Quality – Improved clinical outcomes including lowered HbA1c have been achieved with point-of-care testing
- Operational Efficiency – Rapid tests allow for lean processes and reduce staff time spent in chasing lab results and relaying them to patients
- Patient Satisfaction – The teachable moment not only leads to better patient understanding but can strengthen the relationship between patients and providers

Lian J, Lang Y. *Curr Med Res Opin.* 2014;30(11):2233-40.

Crocker JB, Lee-Lewandrowski E, Lewandroski N, et al. *Am J Clin Pathol.* 2014;142:640-6.

Point-of-Care Testing in General Practice Final Report Jan 2009.

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Questions?

