Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

A Survey of the Management of DKA in Adults in the UK in 2014

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A Brief History

1922

Howard Root in Boston reports reduction in mortality from 12% to 1.6% between 1940 and 1944 – using up to 1770 units of insulin in the 1st 24h after admission

1945

1949

Malins and Black in Birmingham used between 140 and 1400 units of insulin in the first 24h depending on severity in 170 consecutive cases

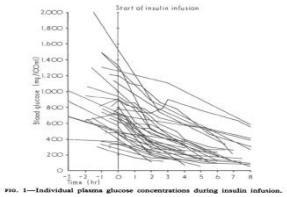
1948

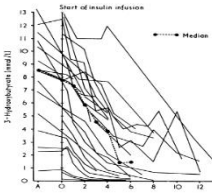
1973

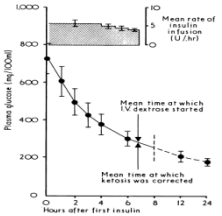
Type 1 diabetes universally fatal

In 1925 Joslin reports that 31 out of 33 patients with DKA survive – with gentle fluid replacement

Micks in Dublin used 100 units for those in 'pre-coma' and 100 units every 15 minutes - between 500 and 2000 units depending on severity of coma







RD Lawrence advocates very aggressive fluid management

3 consecutive papers in the BMJ showed that low dose insulin infusions (5-6 units/hr) work just as well as high dose in lowering glucose & ketones

People Were Still Dying

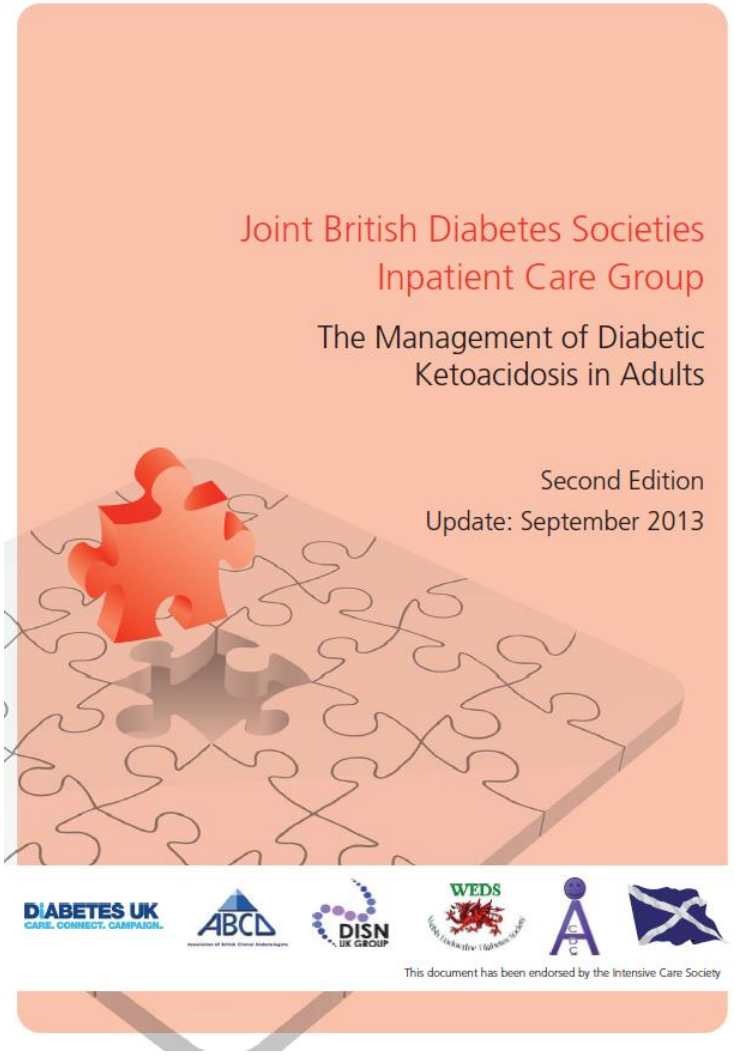
Author (yr)	Age <50 yr No. (% mortality)	Age ≥50 yr No. (% mortality)
Diabetic ketoacidosis		
Fitzgerald et al. (1961)[6]	104 (7%)	56 (21%)
Beigelman (1971)[7]	415 (3%)	67 (29%)
Soler et al. (1973)[8]	207 (4%)	31 (16%)
Keller et al. (1975)[9]	26 (4%)	32 (22%)
Gale et al. (1981)[10]	206 (3%)	111 (43%)
Sheppard and Wright (1982)[11]	239 (2%)	113 (12%)
This study* (1982)	109 (4%)	77 (26%)

- Given 0.1u/kg/hr and 1-2 L of fluid on admission then 1 L every 3-4 hours, and giving potassium 20-40mmol/hour

Carroll P et al Diabetes Care 1983;6(6):579-585

A Question

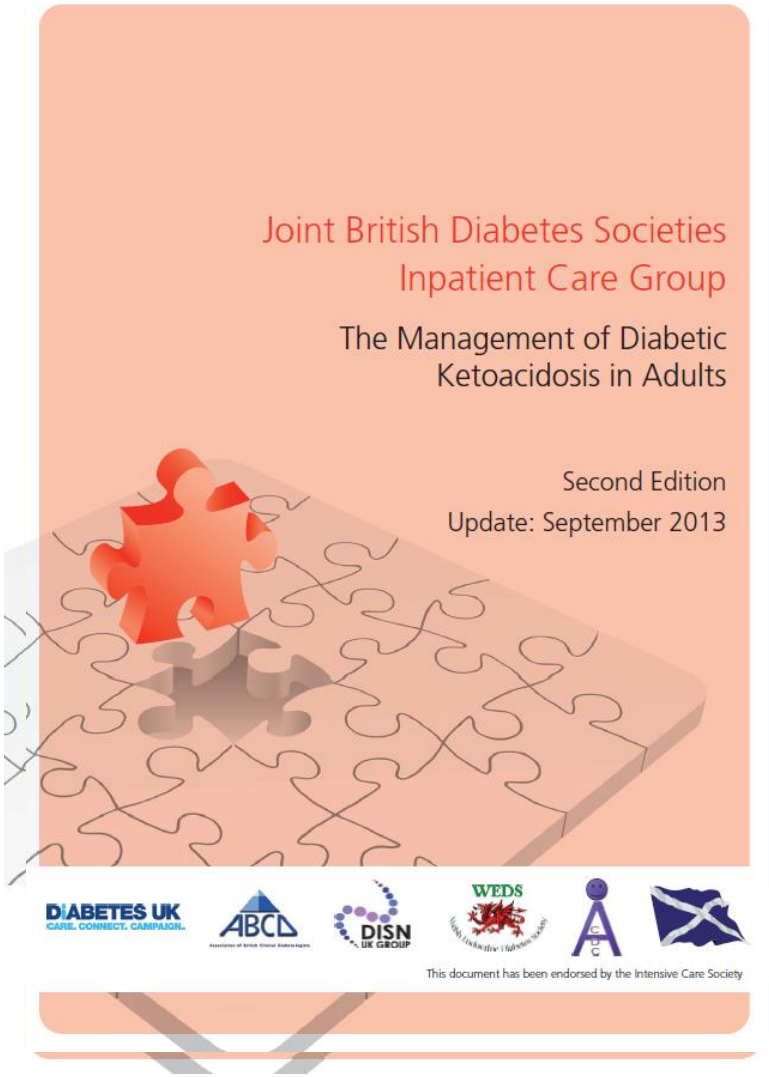
- How do we know that what we are doing is correct?



http://www.diabetologists-abcd.org.uk/JBDS/JBDS.htm

Where Are We Now?

- In 2010 the JBDS produced a guideline on the management of DKA
- With > 20,000 hard copies given out or downloaded
- An updated guideline was published in late 2013
- A national survey was conducted in Autumn 2014



http://www.diabetologists-abcd.org.uk/JBDS/JBDS.htm

What Was Done?

Joint British Diabetes Societies Inpatient Care Group

Data collection tool for the Management of Diabetic Ketoacidosis (DKA) in Adults

(Admission to Discharge)

Name of Hospital: Your grade ☐Consultant ☐SpR ☐CMT ☐DISN ☐Other.....

Year diabetes diagnosed?		Age	Gender: ☐ Male ☐ Female

1. Ethnicity ☐ Not stated

White	Mixed	Asian / British Asian	Black / Black British	Other
☐ a) British ☐ b) Irish ☐ c) Any other white background	☐ d) White /Black Caribbean ☐ e) White / Black African ☐ f) White and Asian ☐ g) Any other mixed background	☐ h) Indian ☐ i) Pakistani ☐ j) Bangladeshi ☐ k) Any other Asian	☐ l) Caribbean ☐ m) African ☐ n) Any other Black background	☐ o) Chinese ☐ p) Any other ethnic group

2. Date / time of Admission: (dd/mm/yy hh:mm) 3. Date / time of Discharge: (dd/mm/yy hh:mm)

4. Did this episode of DKA occur in someone who was already an inpatient? ☐ Yes ☐ No ☐ Not recorded

5. How many previous admissions for DKA have they had in the last 12 months?..... 6. Date of death .....(dd/mm/yy)

7. Cause(s) of death: 1)..... 2)..... 3).....

Diagnosis of DKA (Where appropriate please put a x in the box)

8) Was the diagnosis confirmed according to diagnostic criteria? ☐ Yes ☐ No ☐ N/A

a) Blood ketones ..... mmol/L	**DIAGNOSIS of DKA (JBDS):** Ketonaemia > 3.0mmol/L or significant ketonuria (more than 2+ on standard urine sticks) Blood glucose > 11.0mmol/L or known diabetes mellitus Bicarbonate (HCO3-) < 15.0mmol/L and/or venous pH < 7.3	**10. Was treatment area?** a) ☐ Level 1? (eg general ward area) b) ☐ Level 2? (eg high dependency area) c) ☐ Level 3? (eg ITU) d) ☐ Acute medical unit? e) ☐ A&E f) ☐ Other? (please state) .....
b) Urine ketones		
c) Blood glucose .....mmol/L		
d) pH	**9. If you use different diagnostic criteria for diagnosing DKA – please list them here** Ketones .....mmol/L Glucose.....mmol/L pH..... Other.....	**11. Do you use the JBDS DKA guidelines?** a) ☐ Yes b) ☐ No
e) Bicarbonate .....mmol/L		

Joint British Diabetes Societies Inpatient Care Group

Institutional Standards for the Management of Diabetic Ketoacidosis (DKA) in Adults
(Complete one per Institution)

Name of Hospital:		Date form completed:	
Form completed by		Grade	

(Put N/A= not applicable or NR = not recorded)

1. Guidelines	Yes	No	Don't know
a) Do you have a DKA **treatment pathway**?			
b) Do you have **local guidelines for managing DKA**?			
c) Do you have an **Integrated Care Plan (ICP)** for DKA?			
d) Are your guidelines **current and valid**?			
e) What are your guidelines based on? ☐ i) Joint British Diabetes Societies guidance? ☐ ii) Other..... *(please state)*			

2. Staffing	Yes	No	Don't know
a) In the clinical areas where patients with DKA are initially cared for, do you have **trained health care professionals** available to measure blood ketone levels 24 hours per day?			
b) Do you have **dedicated inpatient diabetes specialist nurses** at a staffing level of 1WTE per 300 beds? If the answer is **NO** – what is your current DISN staffing level per 300 beds?.....WTE			
c) Do you have a **clinical lead** responsible for the implementation & audit of DKA guidelines?			

3. Monitoring	Yes	No	Don't know
a) In the clinical areas where patients with DKA are initially cared for, do you have the facility to **measure blood ketones** in your Trust?			
b) Do you have **blood glucose testing meters that are centrally connected** in your Trust?			

4. Audit / Education	Yes	No	Don't know
a) Do you have **a quality assurance scheme** in place for both glucose and ketone meters?			
b) Have you **audited the outcomes** of your patients admitted with DKA the last past?			
c) Do you **monitor against performance indicators** eg those listed in the JBDS guideline?			
d) Do you have a **rolling educational programme** for medical staff?			
e) Do you have a **rolling educational programme** for nursing staff?			

5. Patients	Yes	No	Don't know
a) Do your patients have **access to the specialist diabetes team within 24 hours of admission?**			
b) Do your patients have the choice to **self-manage their diabetes**?			

Results

- 283 forms were received from 72 hospitals between May and November 2014
- Here is a flavour of the results

Times (Median)

- Admission to diagnosis - 35.5 min
- Admission to starting 09% NaCl - 41.5 min
- Admission to starting FRIII - 60 min
- Admission to resolution - 18.7 hours
- To hospital discharge - 2.6 days

Dhatariya K et al Diabetic Medicine In press DOI: 10.1111/dme.12875

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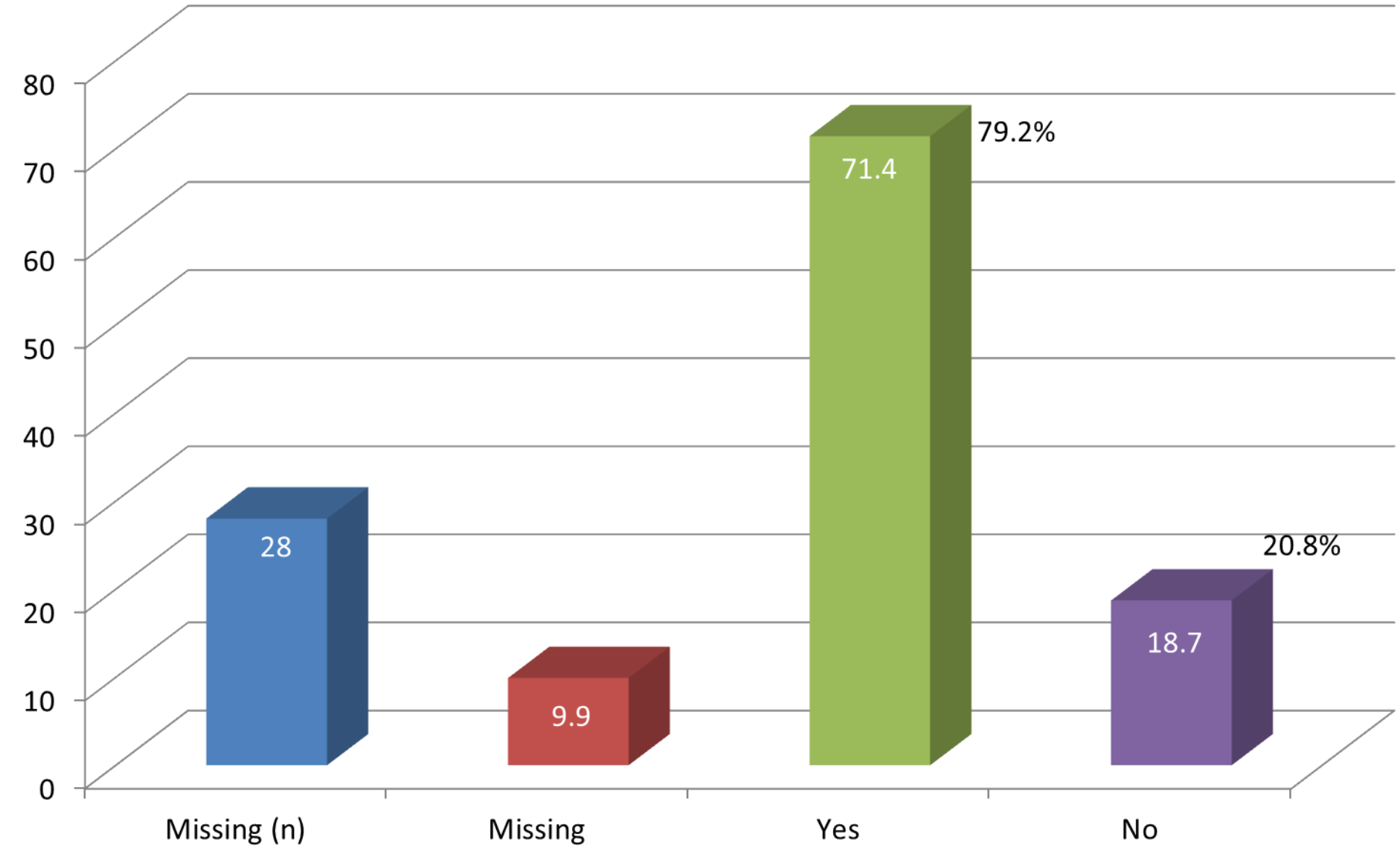
Use of JBDS Criteria? (%)



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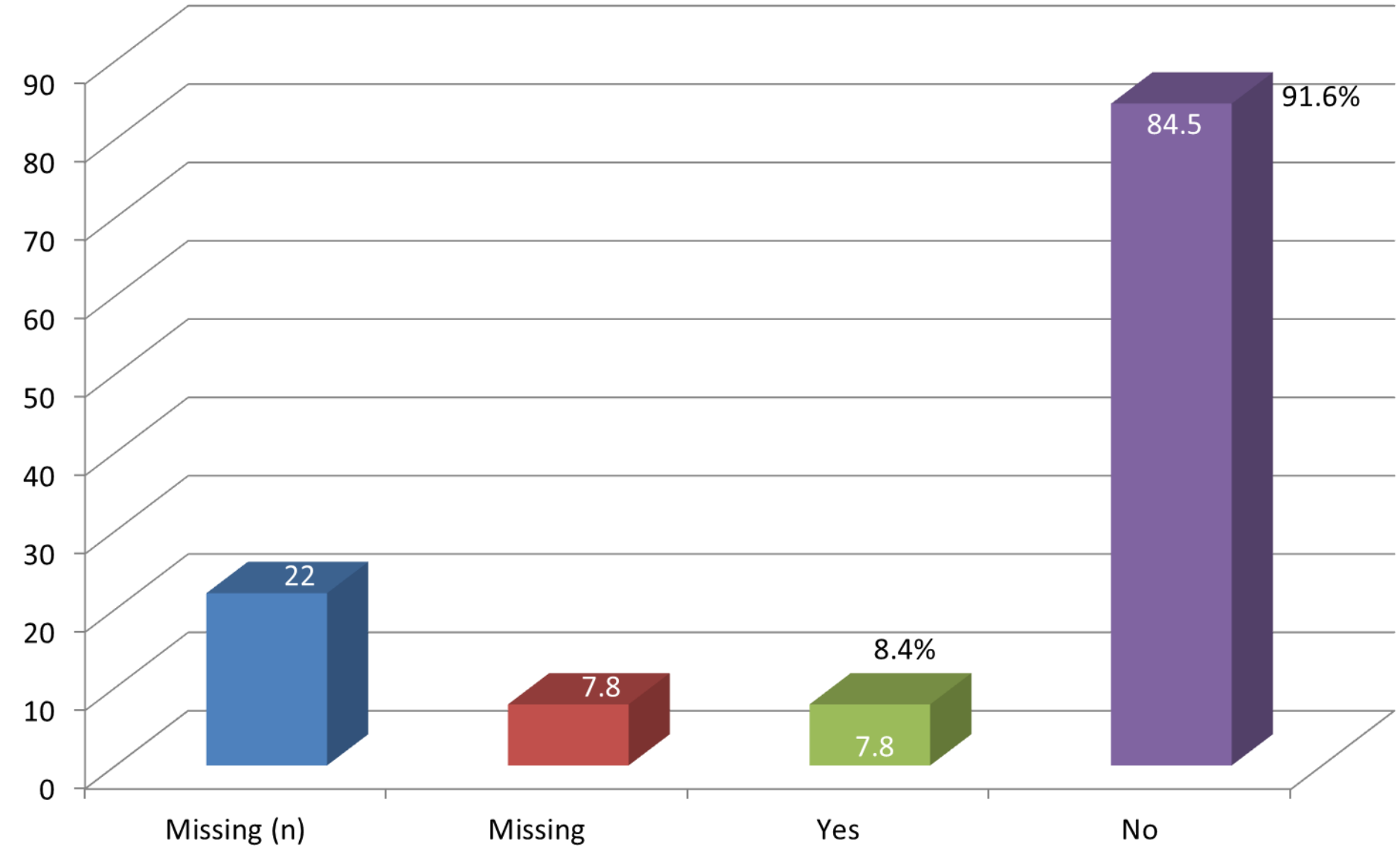
Was the Patient an Inpatient? (%)



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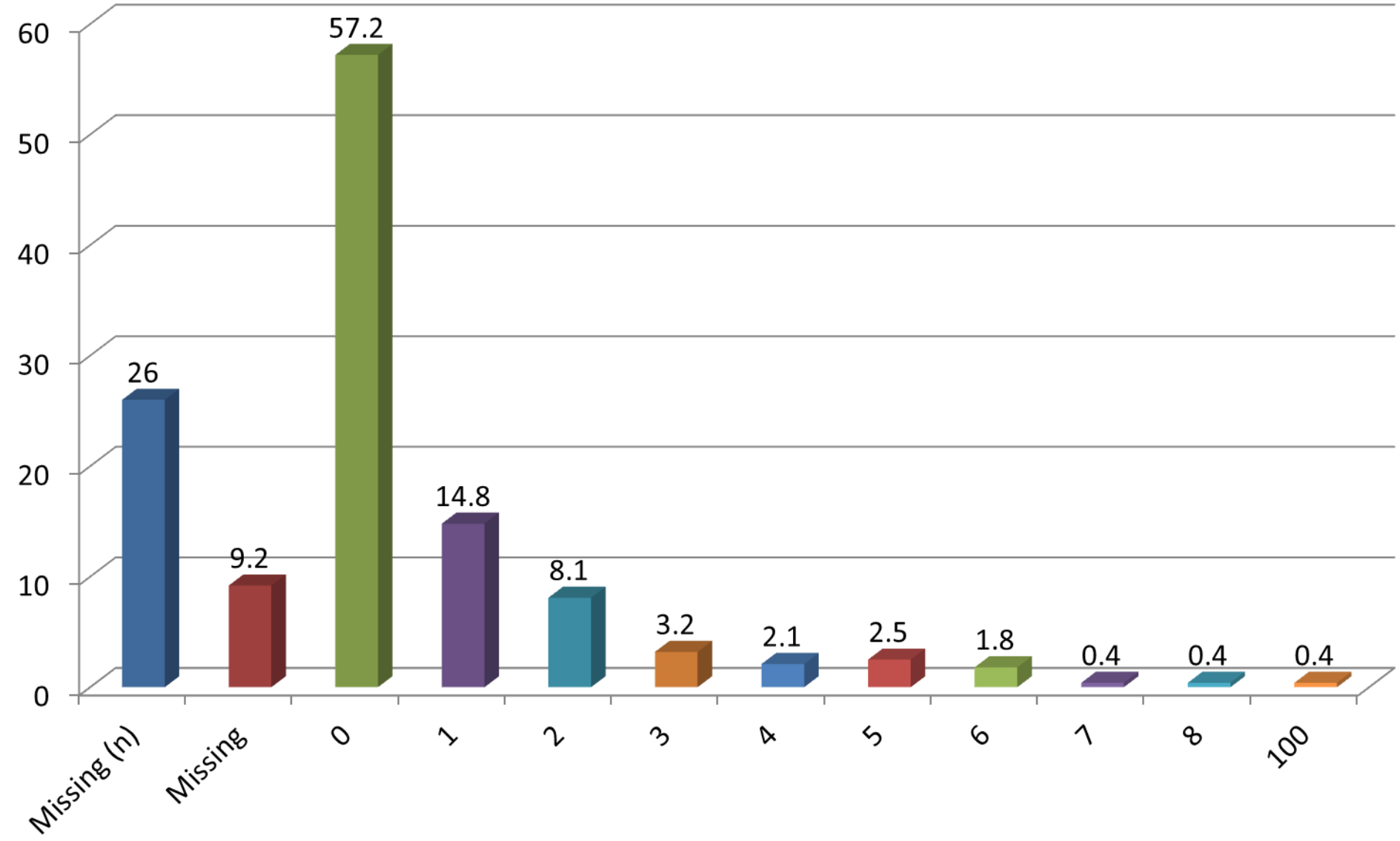
How Many Previous Admissions for DKA in the Last 12 Months? (%)



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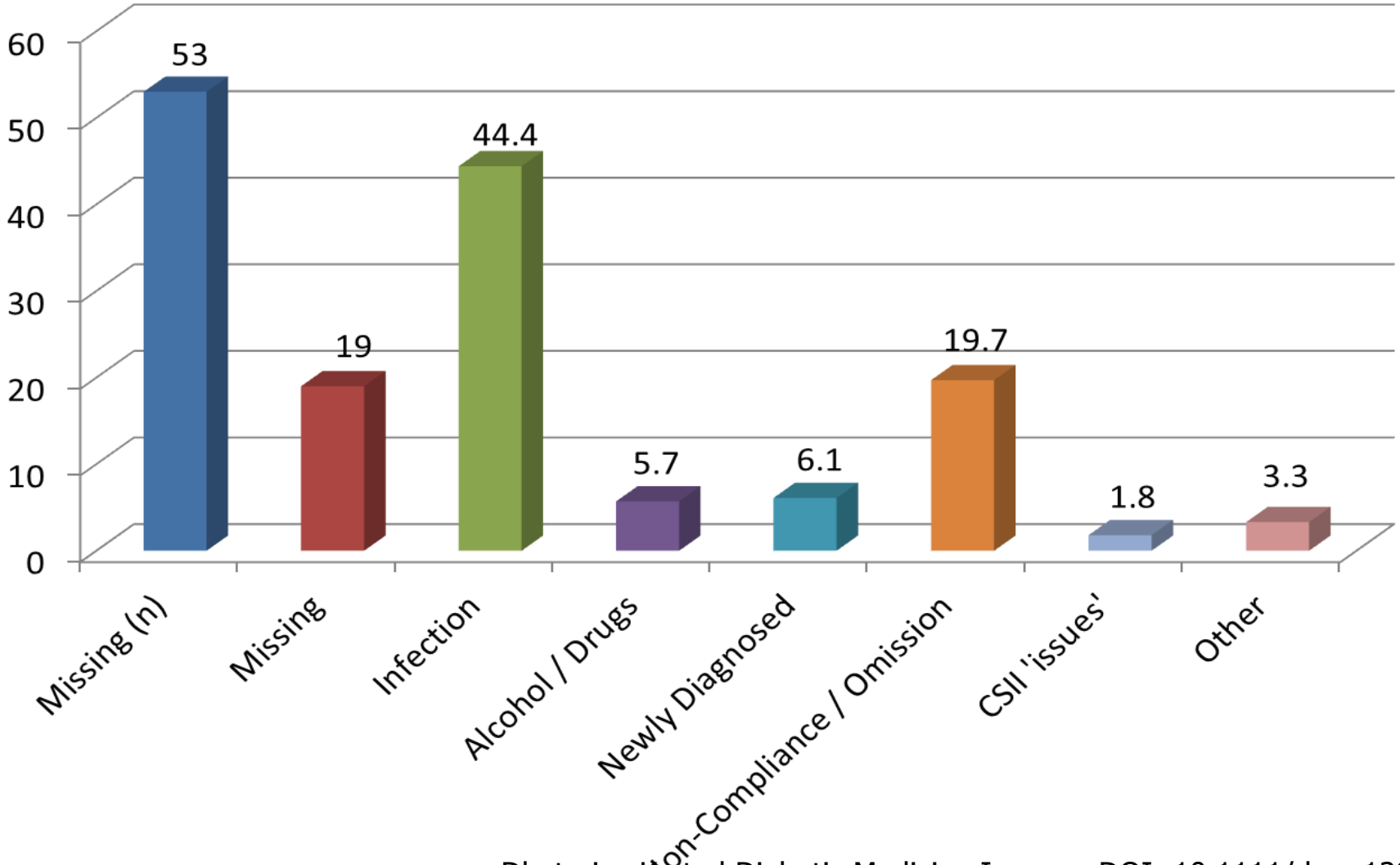
Precipitants (%)



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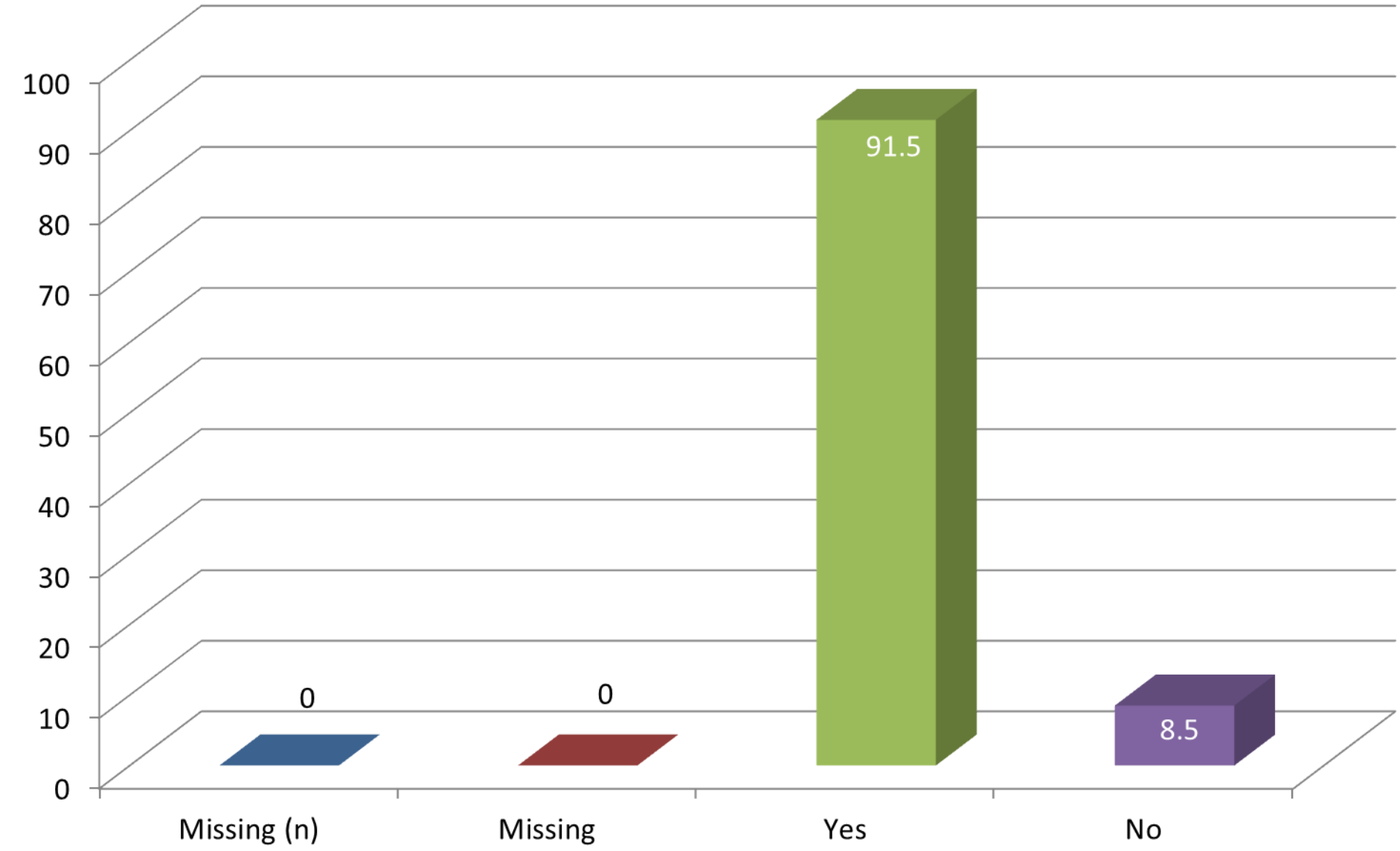
FRIII Used?



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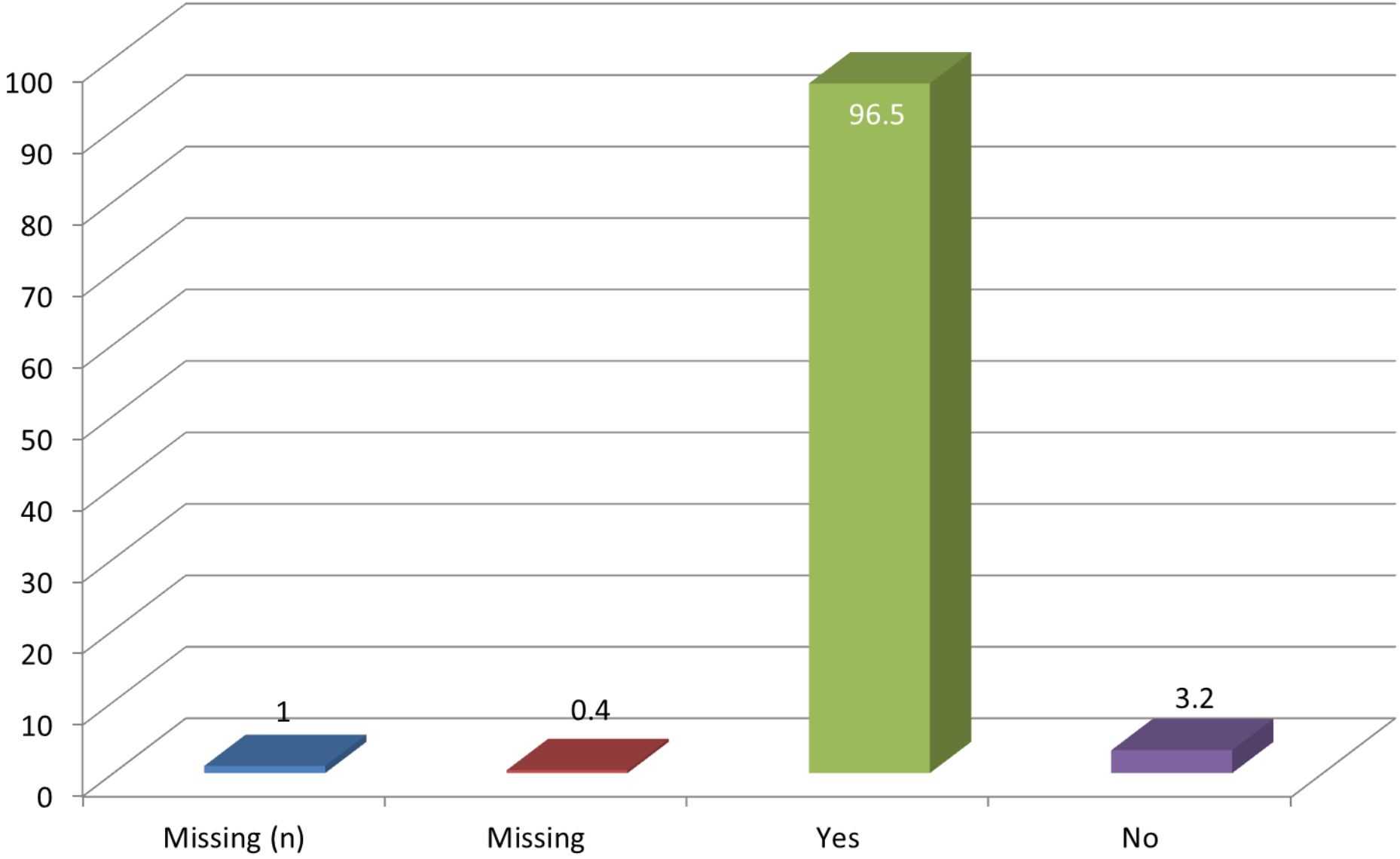
Was Normal Saline Used? (%)



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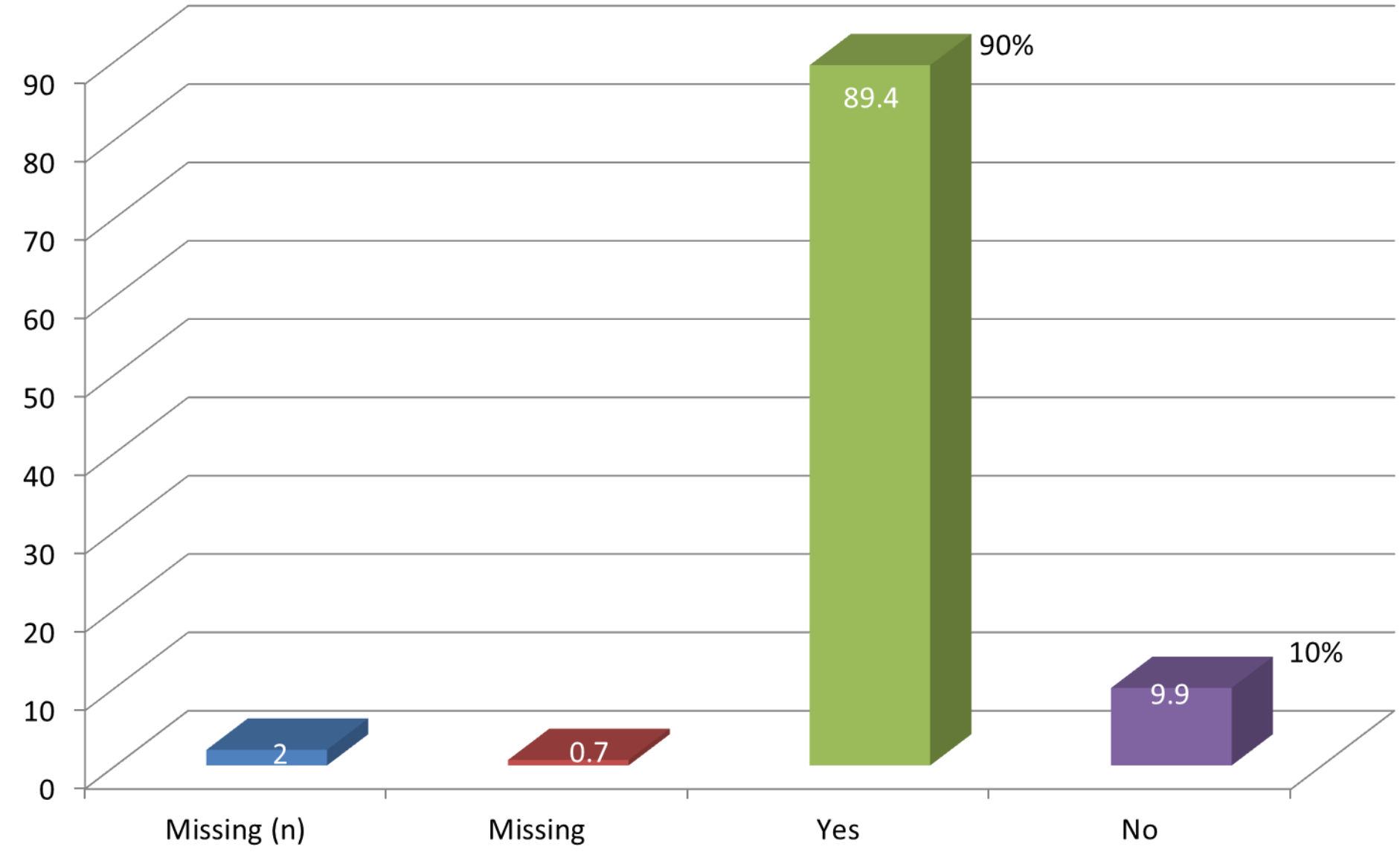
Was IV N Saline Replacement Given as per Guidance? (%)



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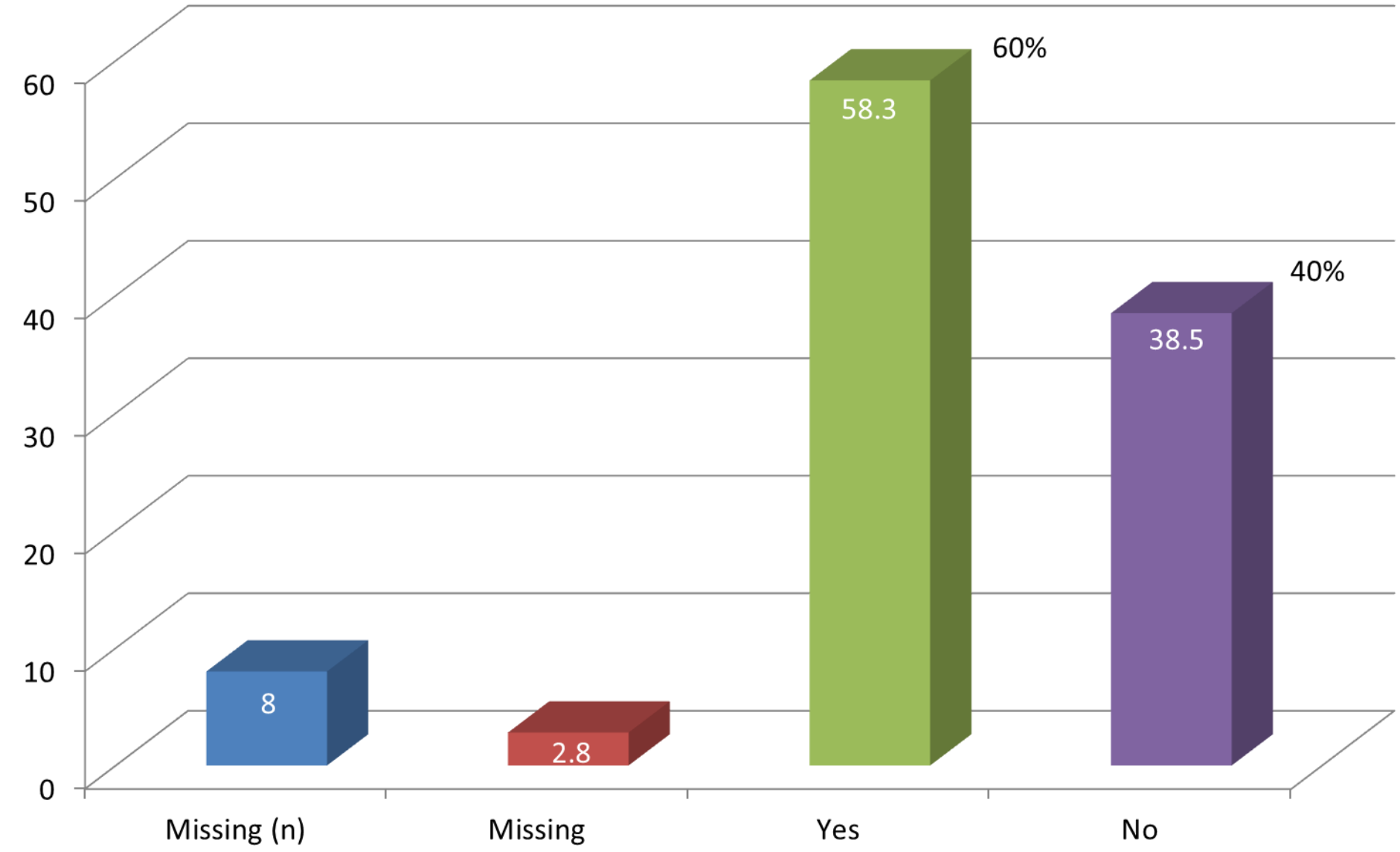
Was a Long Acting Insulin Continued? (%)



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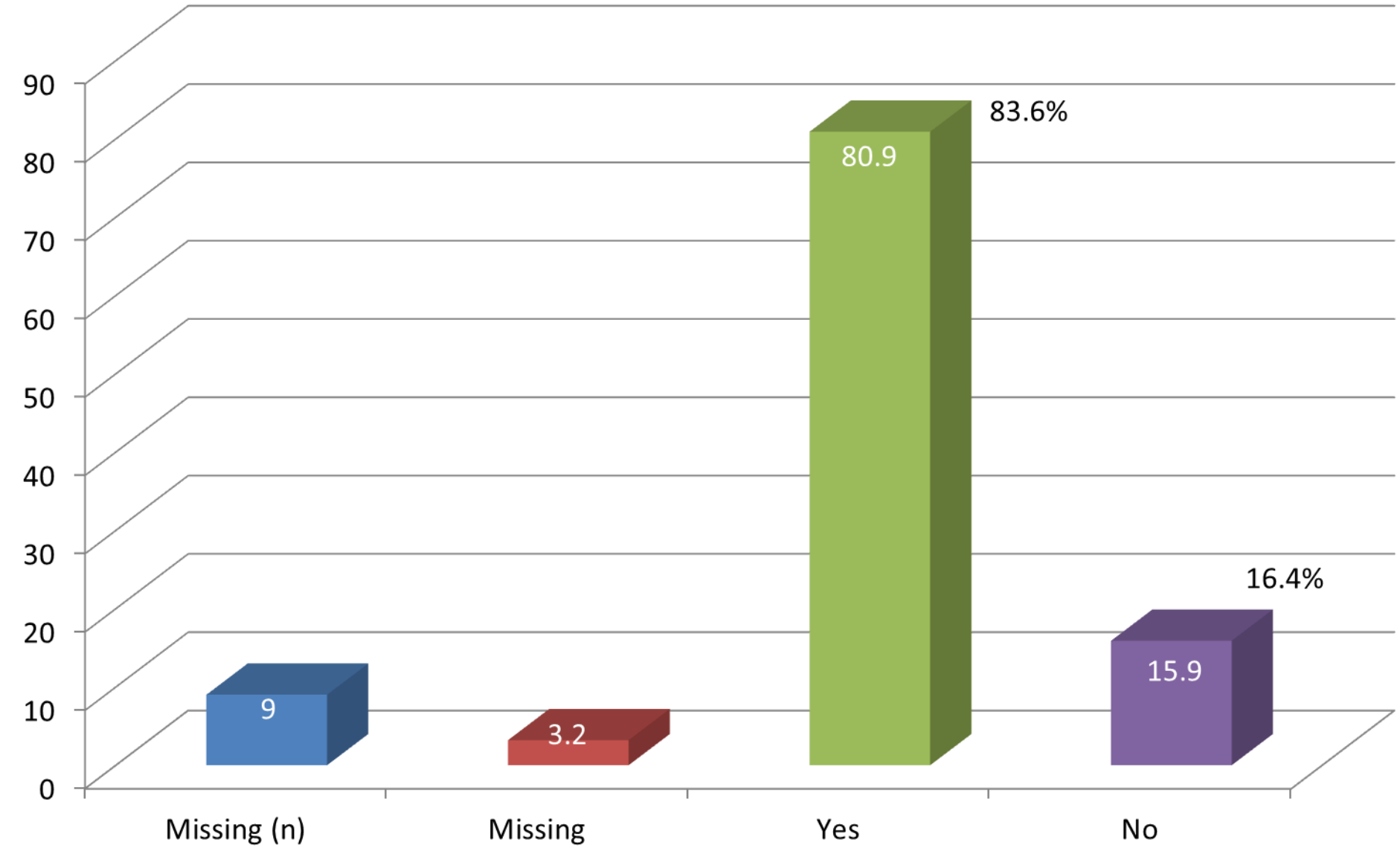
Blood Ketones Recorded? (%)



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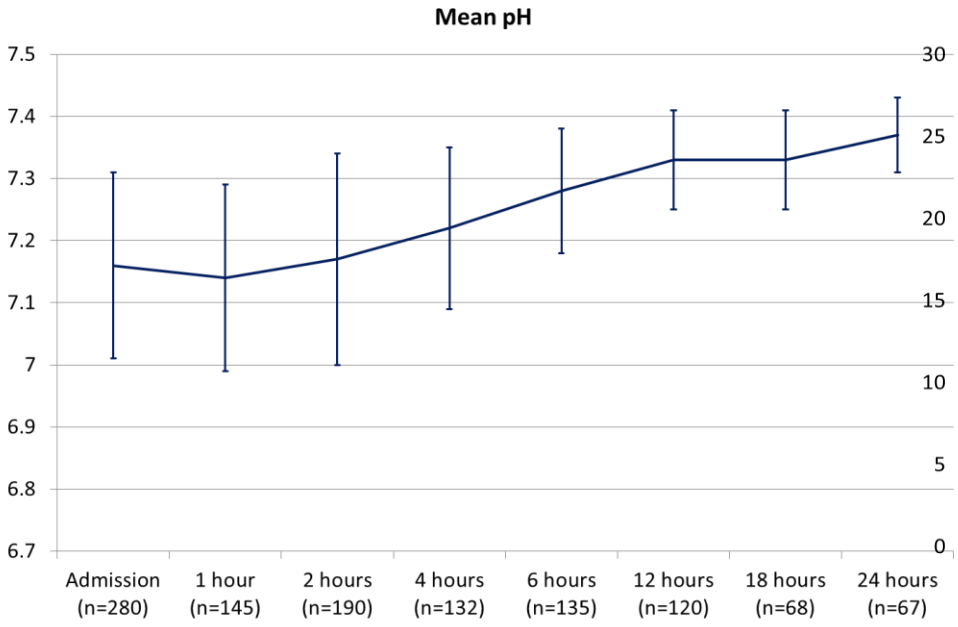
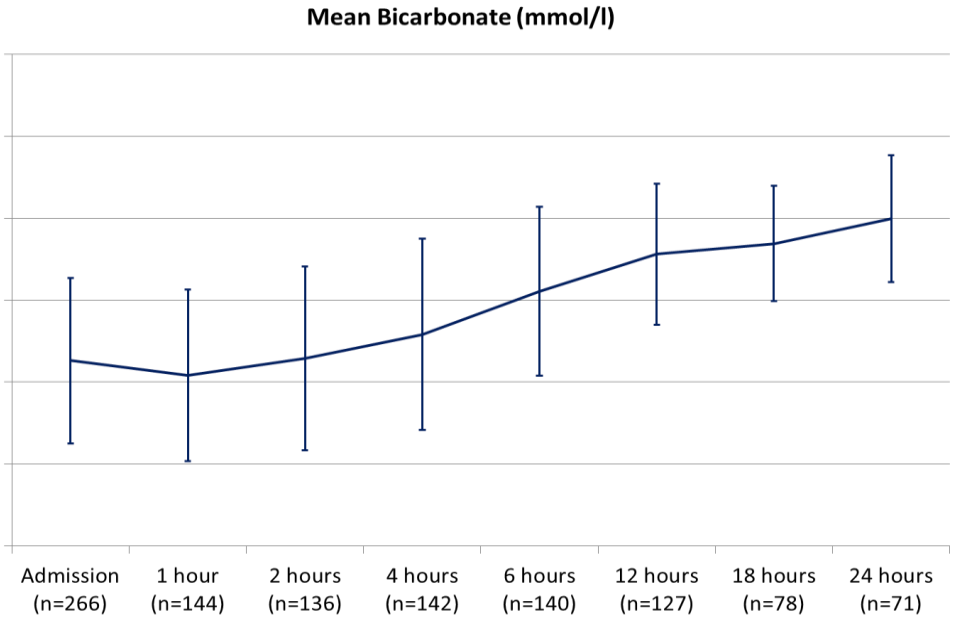
Fixed Rate Intravenous Insulin

- The use of 0.1units/kg/hr led to excellent rises in pH and bicarbonate – so DKA resolved by 18.77 hours





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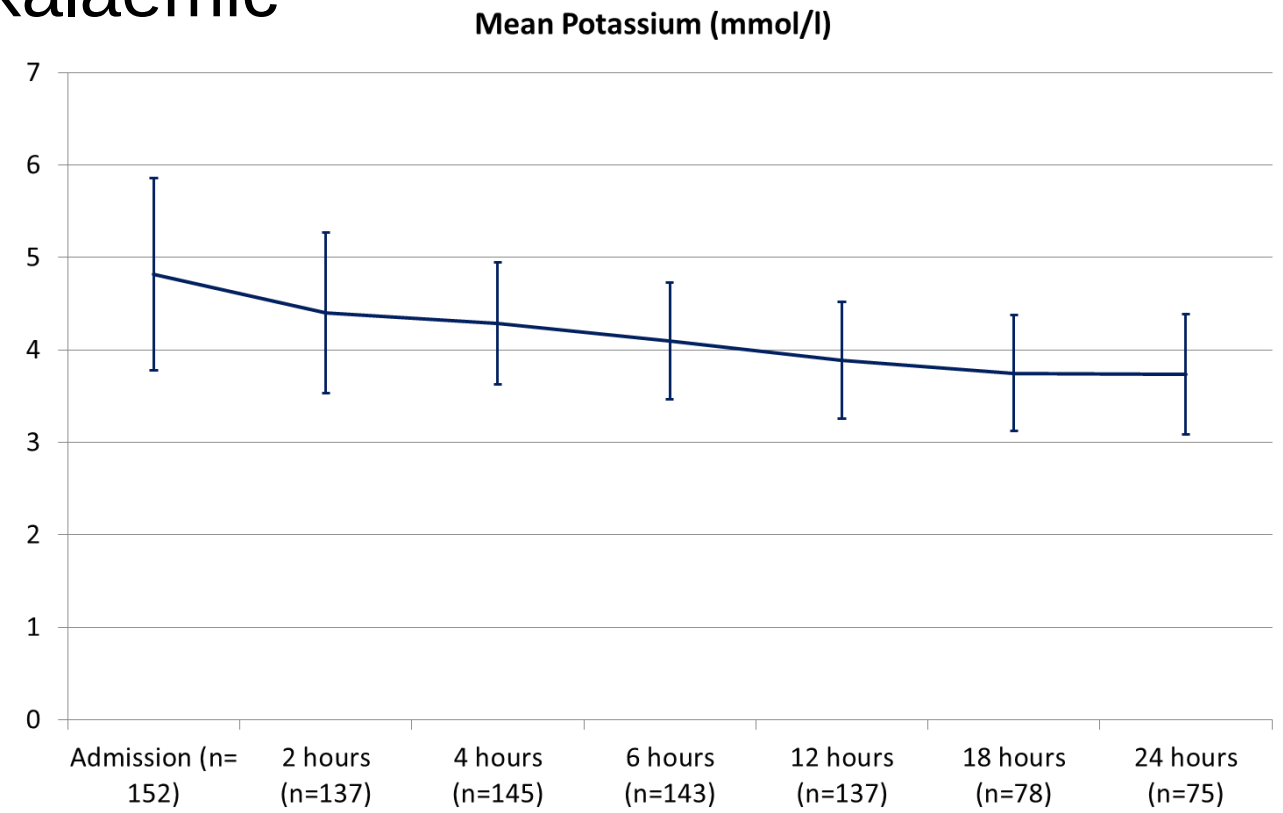
Potassium

- But despite an aggressive potassium replacement regimen – more than 50% of patients became hypokalaemic



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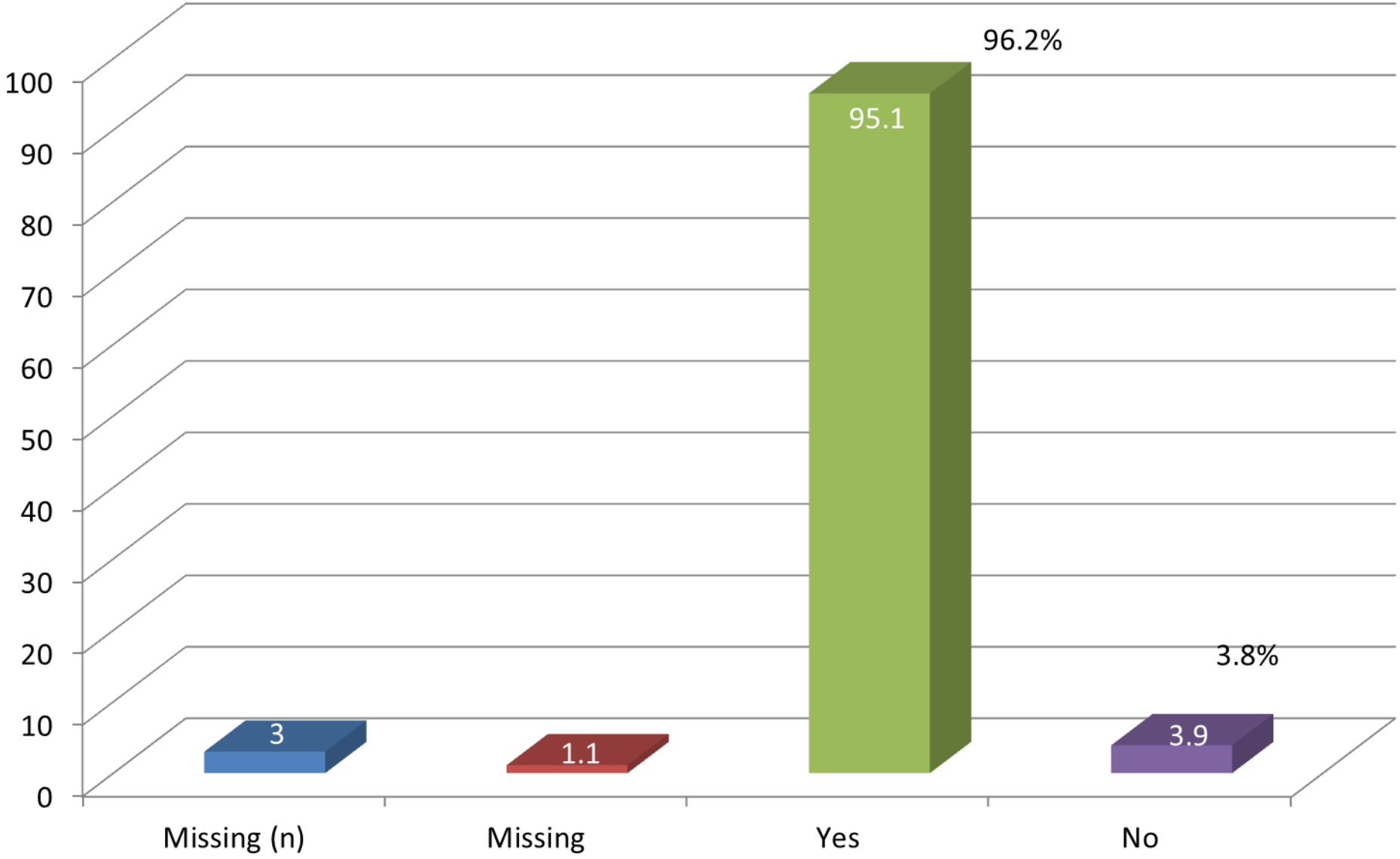
After DKA Resolution, were They Reviewed by the DIST? (%)



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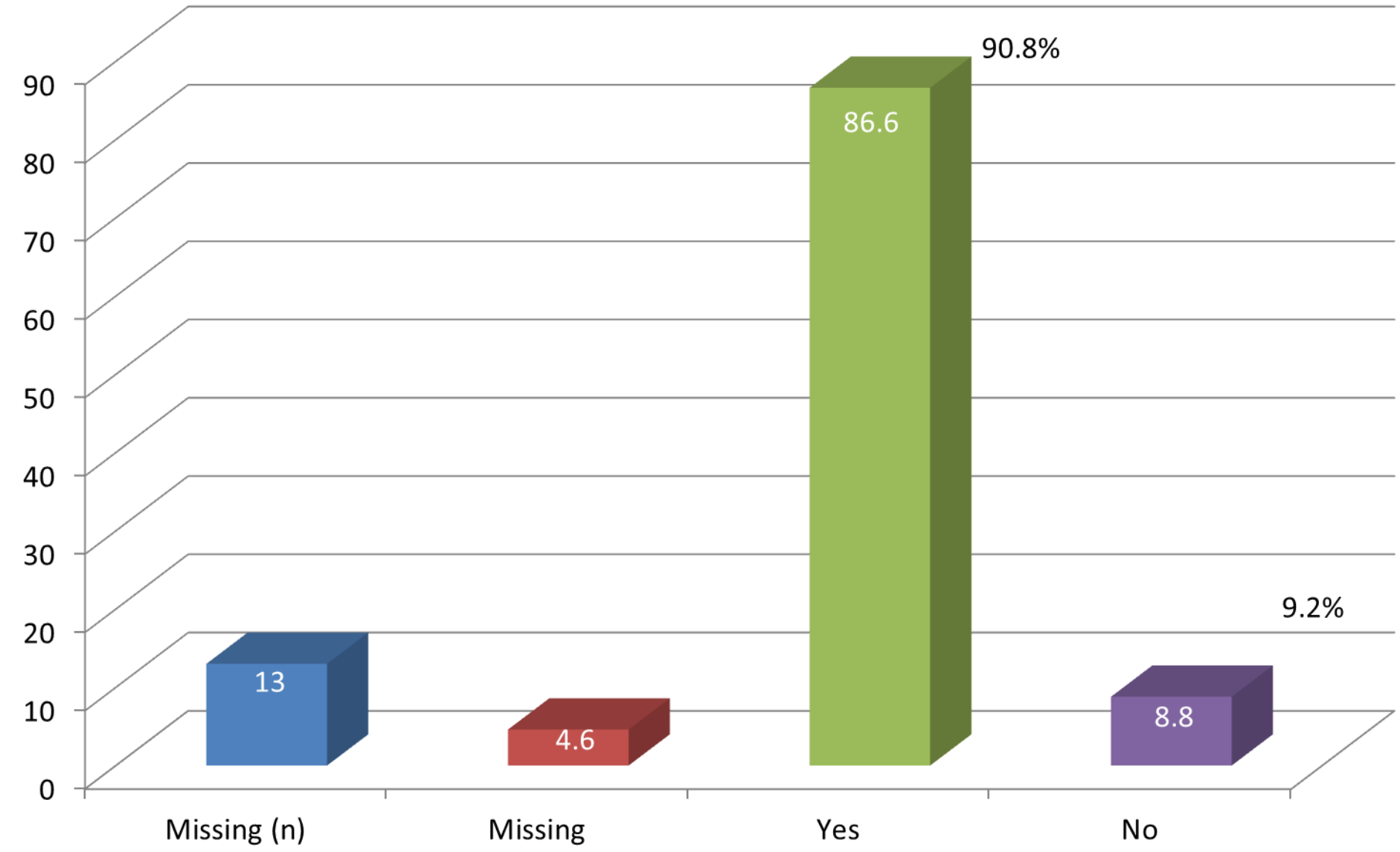
Education Support Received Before Discharge? (%)



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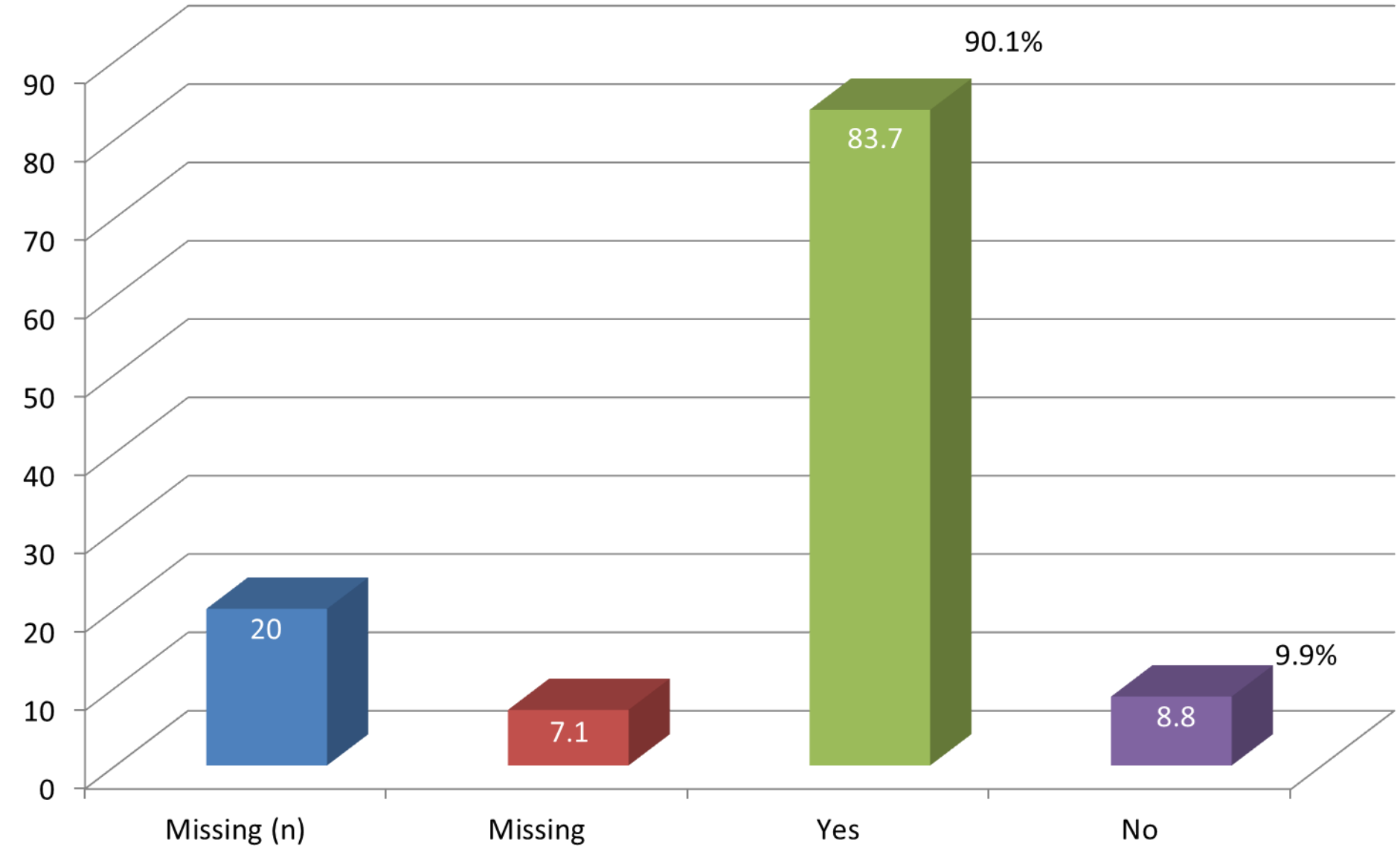
Did the Discharge Letter Contain the Correct Insulin Name? (%)



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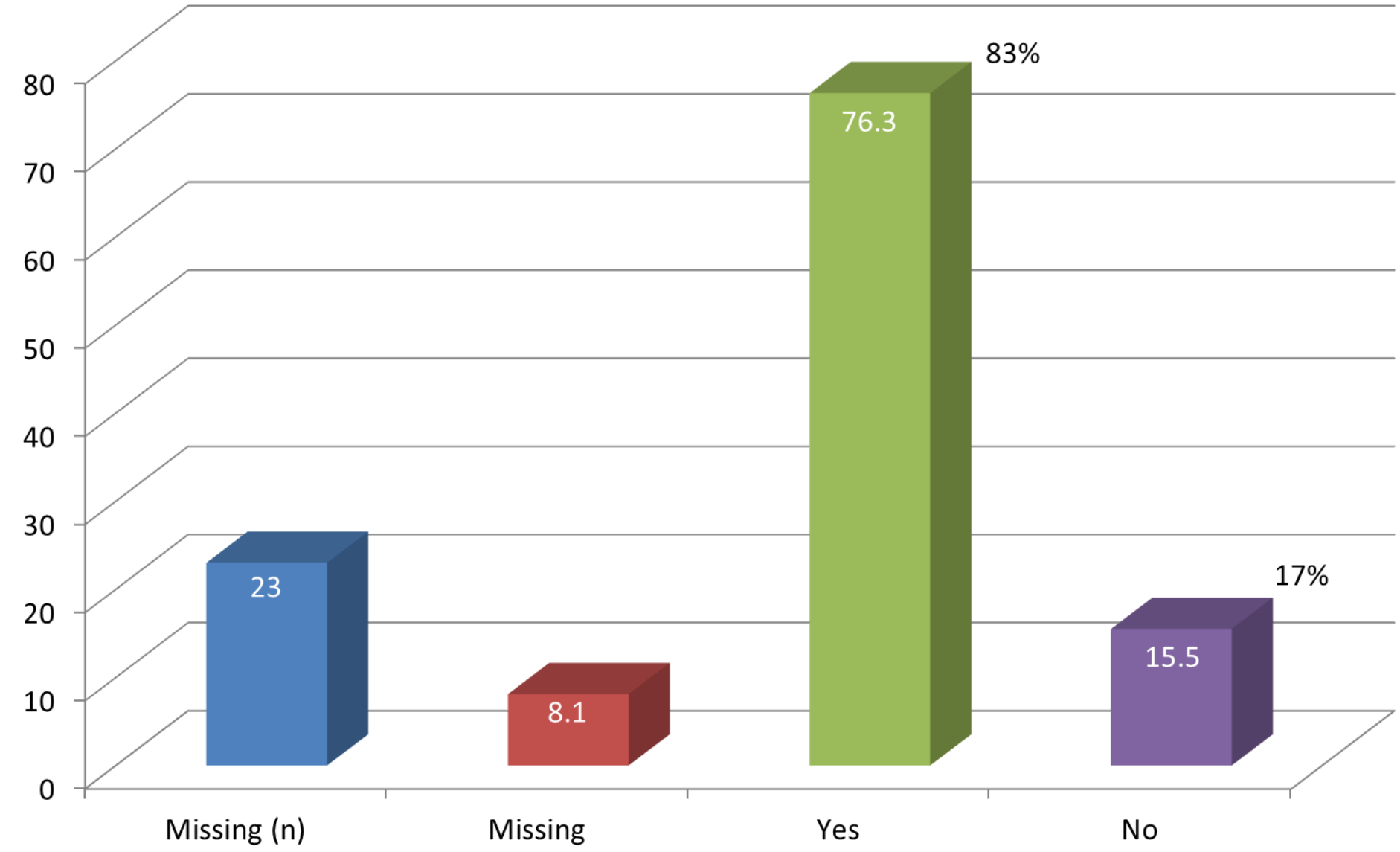
Did the Discharge Letter Contain the Correct Insulin Dose? (%)



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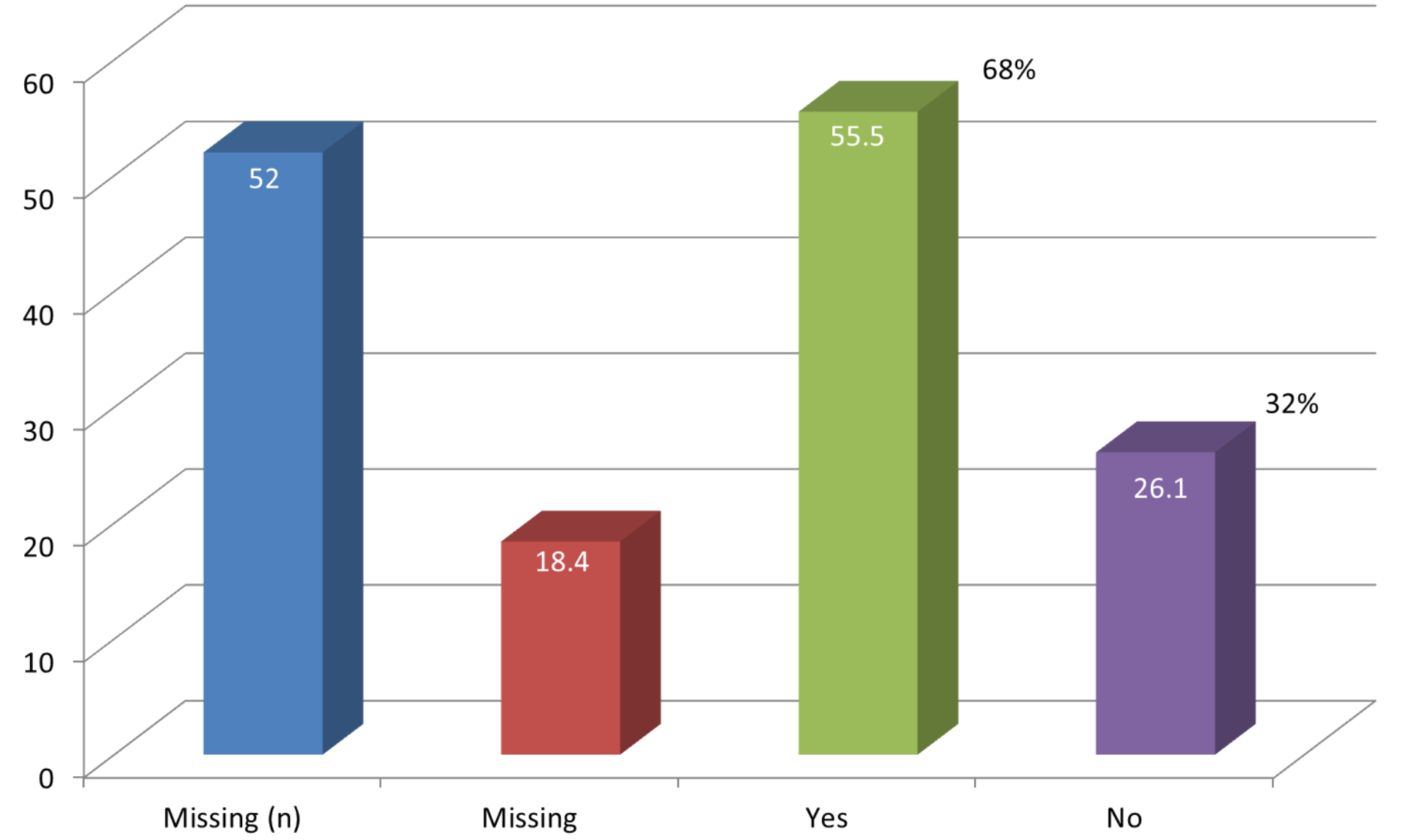
Patient Access to Ketone Testing on Discharge (%)



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Institutional Data

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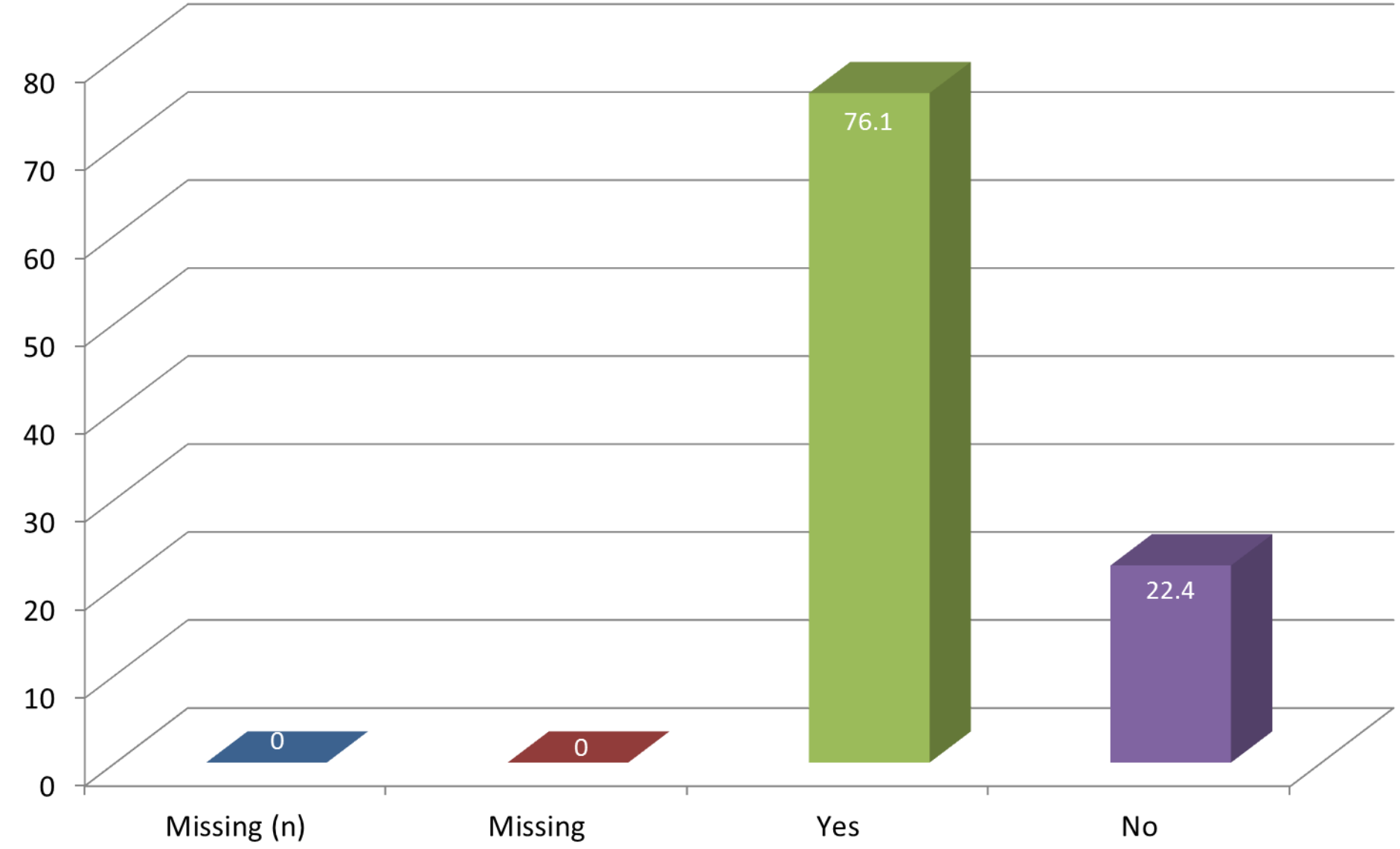
Do You Have the Facilities to Measure Blood Ketones in Your Trust? (%)



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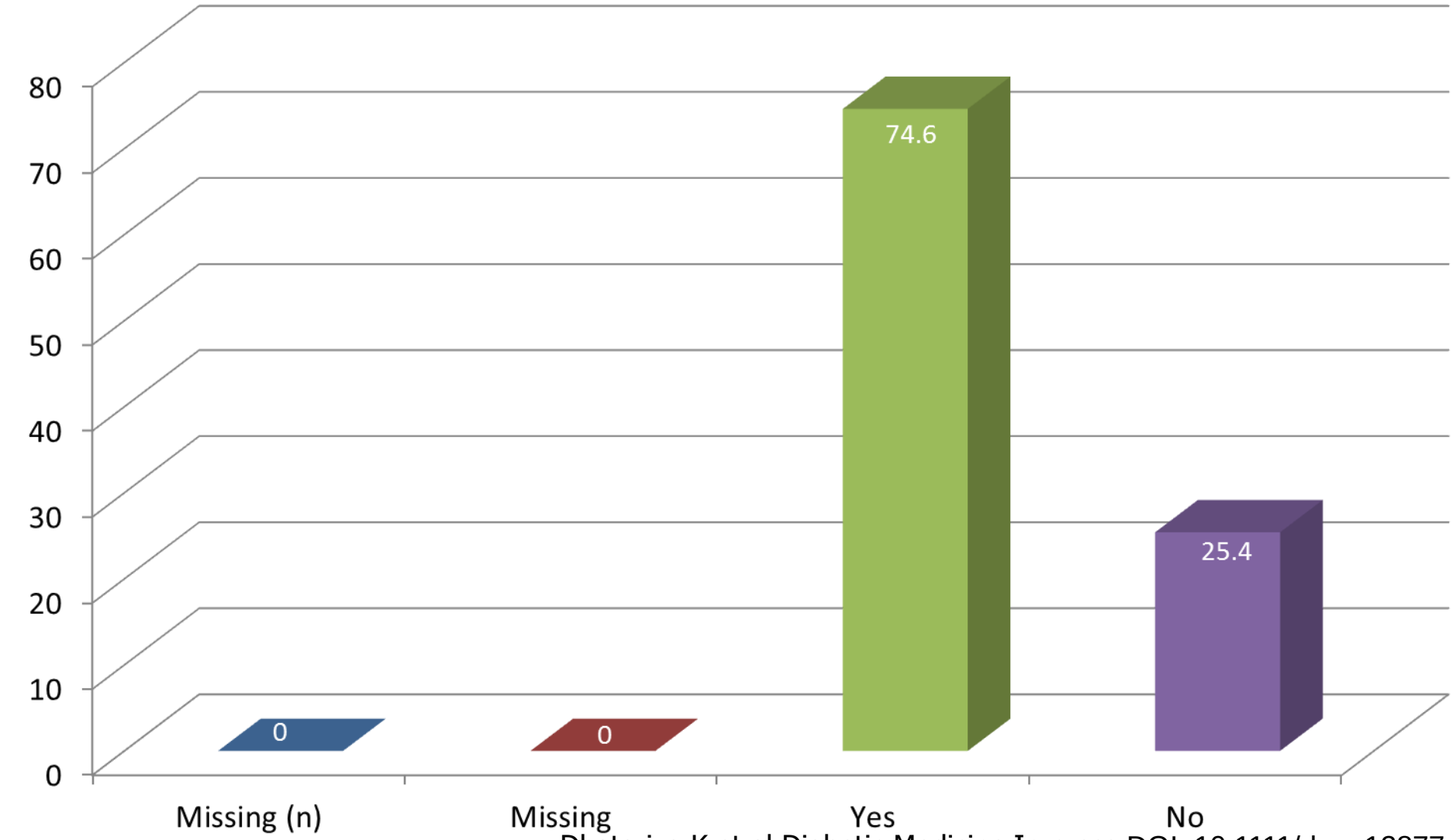
Do You Have a Trained HCP Available to Measure Blood Ketone Levels 24 hrs Per Day? (%)



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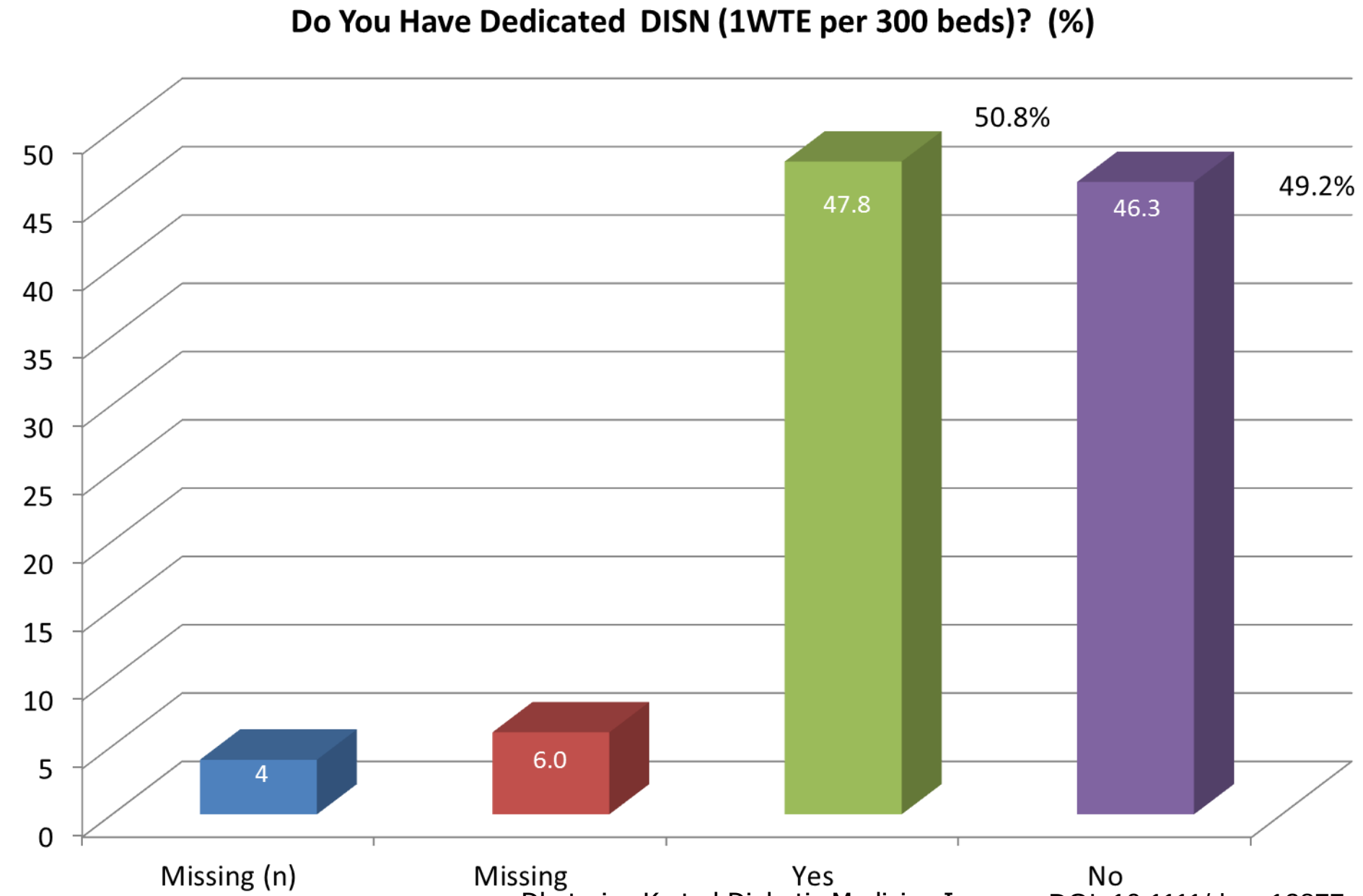

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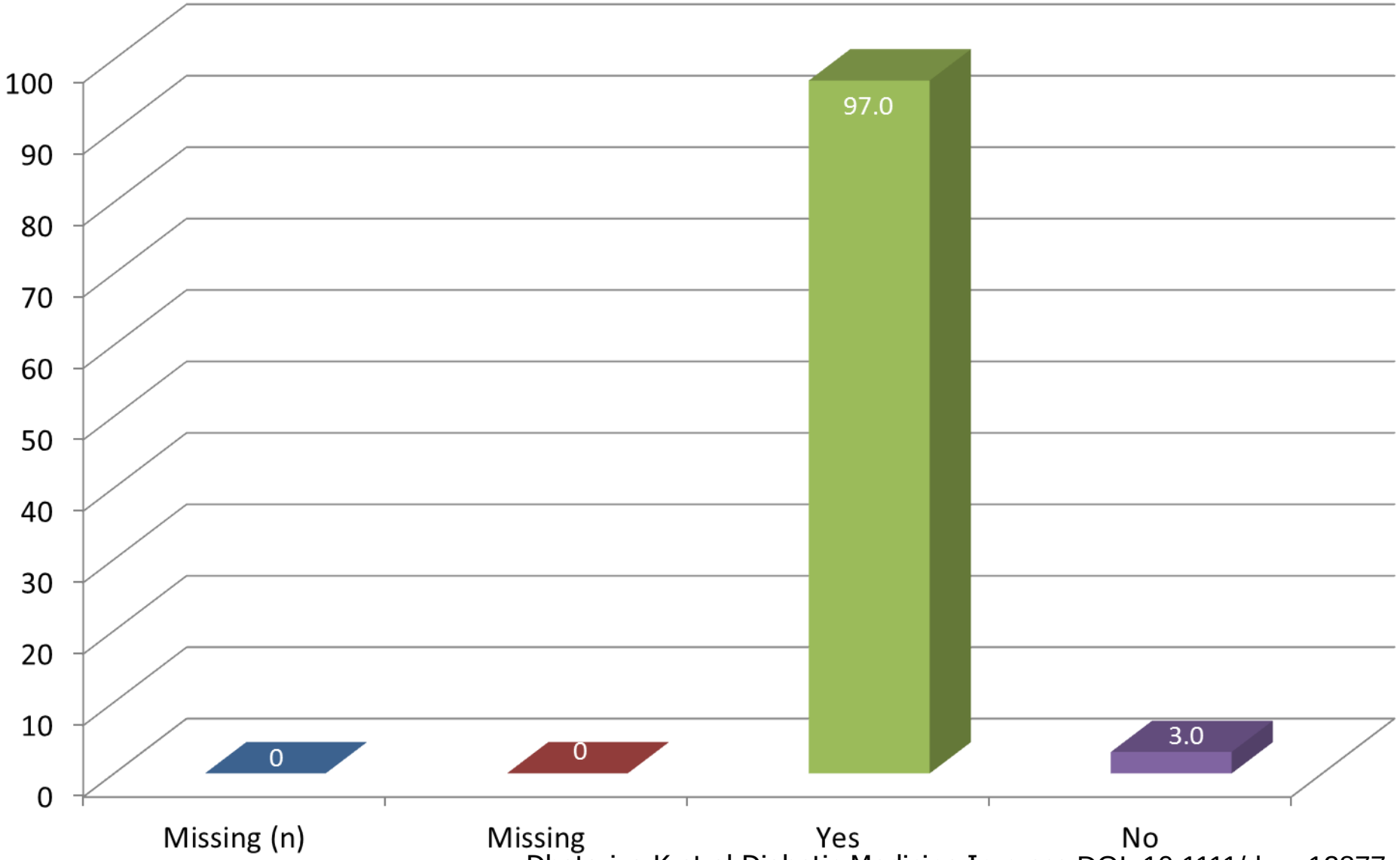
Do You Have a Quality Assurance Scheme in Place for Glucose Meters? (%)



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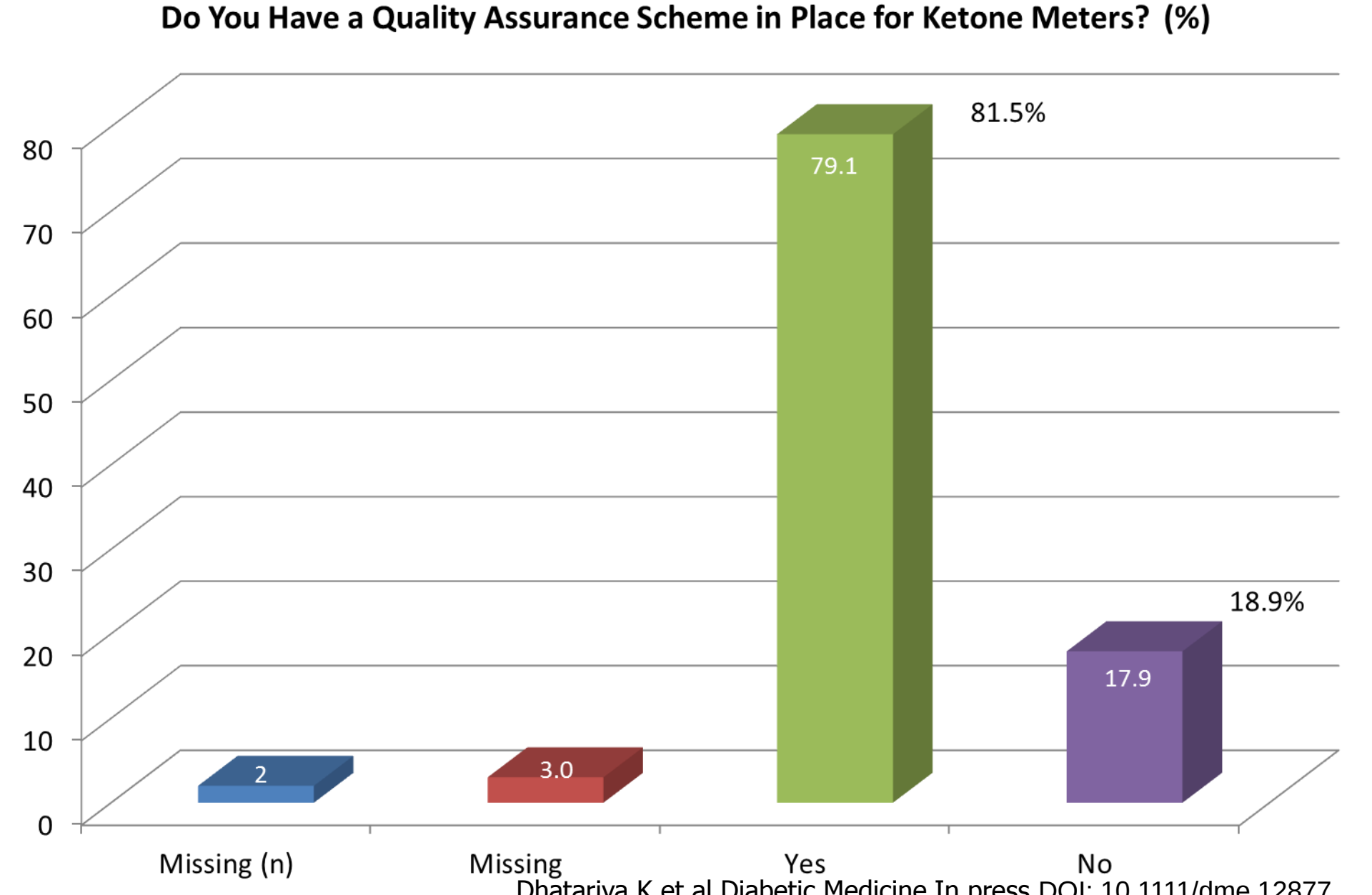

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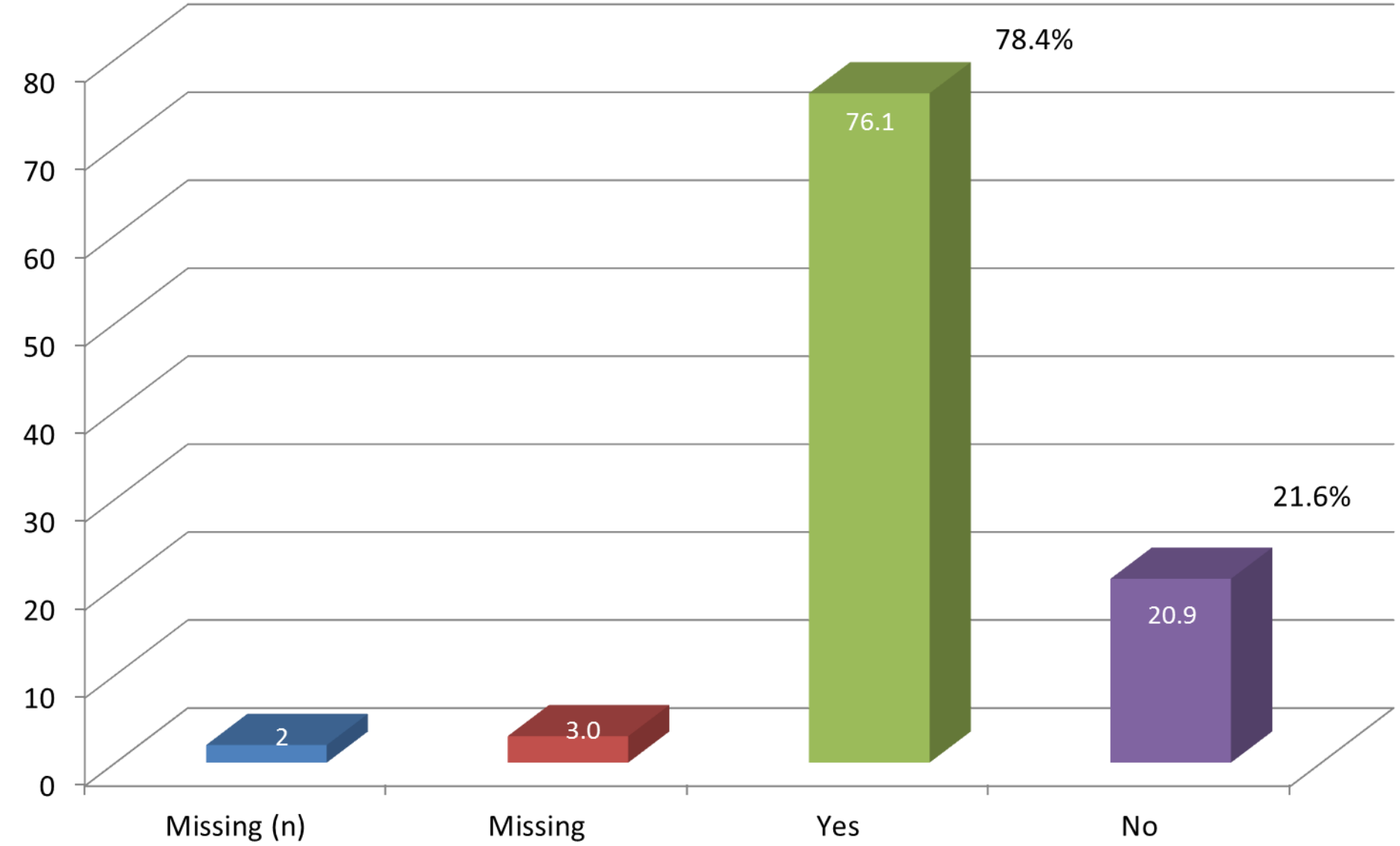
Do You Have a Rolling Educational Programme for Medical Staff? (%)



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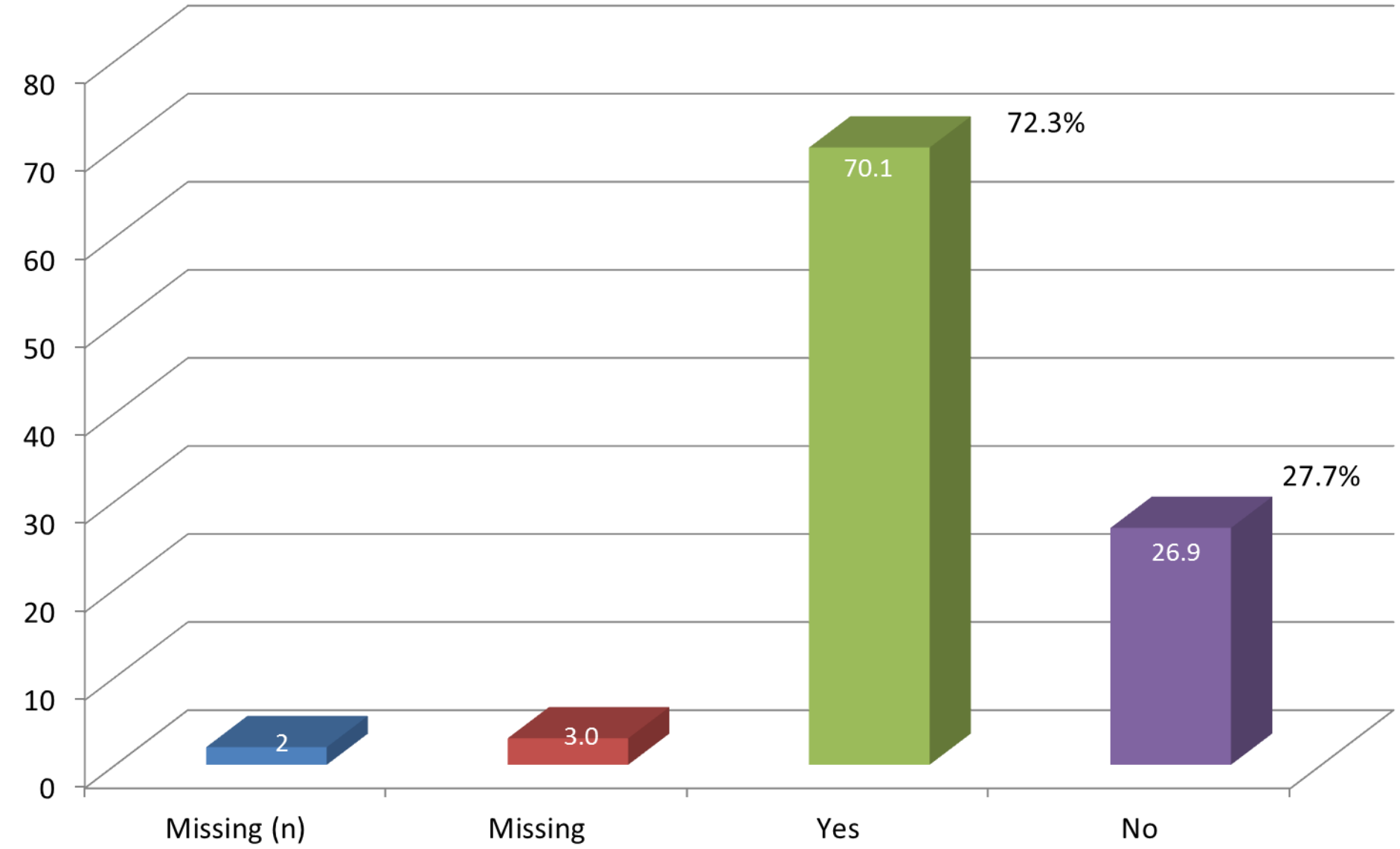
Do You Have a Rolling Educational Programme for Nursing Staff? (%)



Take Home Messages

- Despite the existence of widely adopted national guidance – there are areas that need addressing
- Has the slow evolution of the ‘evidence’ has resulted in ‘complacency’?
- We need to make sure the guidance that we give has a robust evidence base
- No harm came to patients as a result of the low glucose or potassium – does the guideline need to change?

Ongoing Work

- We used the same form to look at outcomes for 14-18 year olds (submitted) and 0-14 year olds (being analysed)
- We are currently doing an economic analysis of DKA admissions
- Collecting data from 50 consecutive admissions from my own hospital to see if the national data can be translated into individual hospitals

A Familiar Timeline

1922

Type 1 diabetes universally fatal

In 1925 Joslin reports that 31 out of 33 patients with DKA survive – with gentle fluid replacement

RD Lawrence advocates very aggressive fluid management

1945

Howard Root in Boston reports reduction in mortality from 12% to 1.6% between 1940 and 1944 – using up to 1770 units of insulin in the 1st 24h after admission

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Micks in Dublin used 100 units for those in 'pre-coma' and 100 units every 15 minutes - between 500 and 2000 units depending on severity of coma

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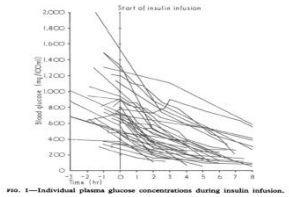

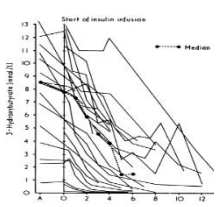

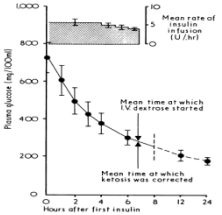

3 consecutive papers in the BMJ showed that low dose insulin infusions (5-6 units/hr) work just as well as high dose in lowering glucose & ketones

2010

The first national guideline for managing DKA published

Updated in 2013

2014

Survey of current management

?

Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

A Survey of the Management of DKA in the UK in 2014

www.norfolkdiabetes.com

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