Factors Influencing Timeliness of Immunisation Among Children Aged Below 23 Months In The Tamale Metropolis

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BACKGROUND 1/2

- Childhood Immunisation is a key healthcare intervention

    ✓ averts between 2 and 3 million deaths annually around the globe

- Effective **monitoring** key for quality improvement

    ✓ but monitoring largely skewed towards coverage estimates

    ✓ Danger : mask potential discrepancies e.g. age-appropriateness (timeliness)

- **Timeliness** refers to immunisation at the earliest "*appropriate age*"

- The right time ? The appropriate age ? Clearly spelt out in:

    ✓ Various WHO "*Position Papers*"

    ✓ country-specific immunisation schedules eg the EPI in Ghana

Walton et al., 2017

BACKGROUND 2/2

- Many authors have demonstrated poor timeliness **in the setting of high immunisation coverage**

  ✓ France :   58% untimely , though coverage >90%   (Bailly et al., 2018)
  ✓ China :   Only a quarter of BCG vaccines on time   (Hu et al, 2014)
  ✓ Ethiopia :   Median delays of **2 months**   (Boulton et al.,2019)
  ✓ Nigeria :   up to 65% delayed in Nigeria   (Sadoh & Eregie, 2009)
  ✓ Burkina Faso :   only 48% on time (Penta Coverage >93%)   (Schoeps et al., 2014)
  ✓ Brong Ahafo: delays in 55% of children   (Gram et al.,2014)
  ✓ Kumasi,Ghana.   delays range 2.7% – 16.7%   (Laryea et al.,2014)

- High coverage may mask **hidden challenges** such as timeliness / age-appropriateness
  ✓ Not enough that children receive their immunisations ; Must be **given on time**.
  ✓ Baseline timeliness helpful to mitigate health system shocks eg COVID pandemic

Mhatre et al .,2009 | Bailly et al., 2018 | Hu et al., 2014 | Gram et al., 2014 | Boulton et al.,2019 | Sadoh & Eregie, 2009 | Laryea et al.,2014

Methods

- Hospital-based cross sectional study was conducted among **424** caregiver-child pairs in 5 health facilities in the Tamale metropolis

- **Eligibility**
  - ✓ children aged between 0 and 23 months
  - ✓ at least one immunization administered, (must have immunisation records)

- **Data Collection and Processing**
  - ✓ Primary data : paper-based semi-structured questionnaire with 39 items in 3 sections.
  - ✓ Secondary data from combined maternal and child health records book.
  - ✓ Processed and Cleaned in Ms. Excel

- **Data Analysis**
  - ✓ Outcome variable was timeliness of immunization (categorized not continuous)
  - ✓ descriptive and inferential statistics with SPSS version 26. *(Cross tabs, frequencies and bivariate logistic regression to determine factors associated with immunization timeliness)*
  - ✓ Statistical significance at 95% CI was set at $p < 0.05$

Methods 2/2

- **Approx. Age of child** : calculated from date of birth and date of interview

- **Immunisation timeliness** : calculated as the difference between expected / scheduled date and documented date of immunization.

- **Primary outcome** (timeliness) was dichotomized as timely and untimely.

  - ✓ A difference within 14 days was deemed timely

  - ✓ any figure <14 or > 14 was deemed untimely.

- Permission to conduct this study was granted by the Northern Regional Health directorate , the Tamale Metro health Directorate and the Tamale Teaching Hospital

- Ethical clearance was granted by the CHRPE of KNUST.

Results

- 100% response, 3 discarded, 421 records included for analysis

- 206 (48.9%) male and 215(51.1%) female

- **Gestational age** : 94 (22.3%) born preterm

- **Birth weight** : 57(13.6%) Low birth weight

- **Age of infants** : 1.4 months to 22.8 months (mean age 8.3 months)

- **Average immunization timeliness** was **69.8 %**
  - ✓ range from 51.4 % to 87 %
  - ✓ Averagely **30.3** % of immunizations untimely (range 13.1 % at birth to 48.6 % in the 9th month)

SCHEDULED TIME	Total respondents with documented immunisation (average)	% timely	% untimely
At birth	384	87.0	13.1
6 weeks	419	82.4	17.7
10 weeks	406	76.8	23.2
14 weeks	346	67.7	32.3
9 months	146	51.4	48.6
18 months	29	53.5	46.6

Immunization timeliness in the Tamale metropolis

Results

- Generally as the child's age increased, immunization timeliness decreased
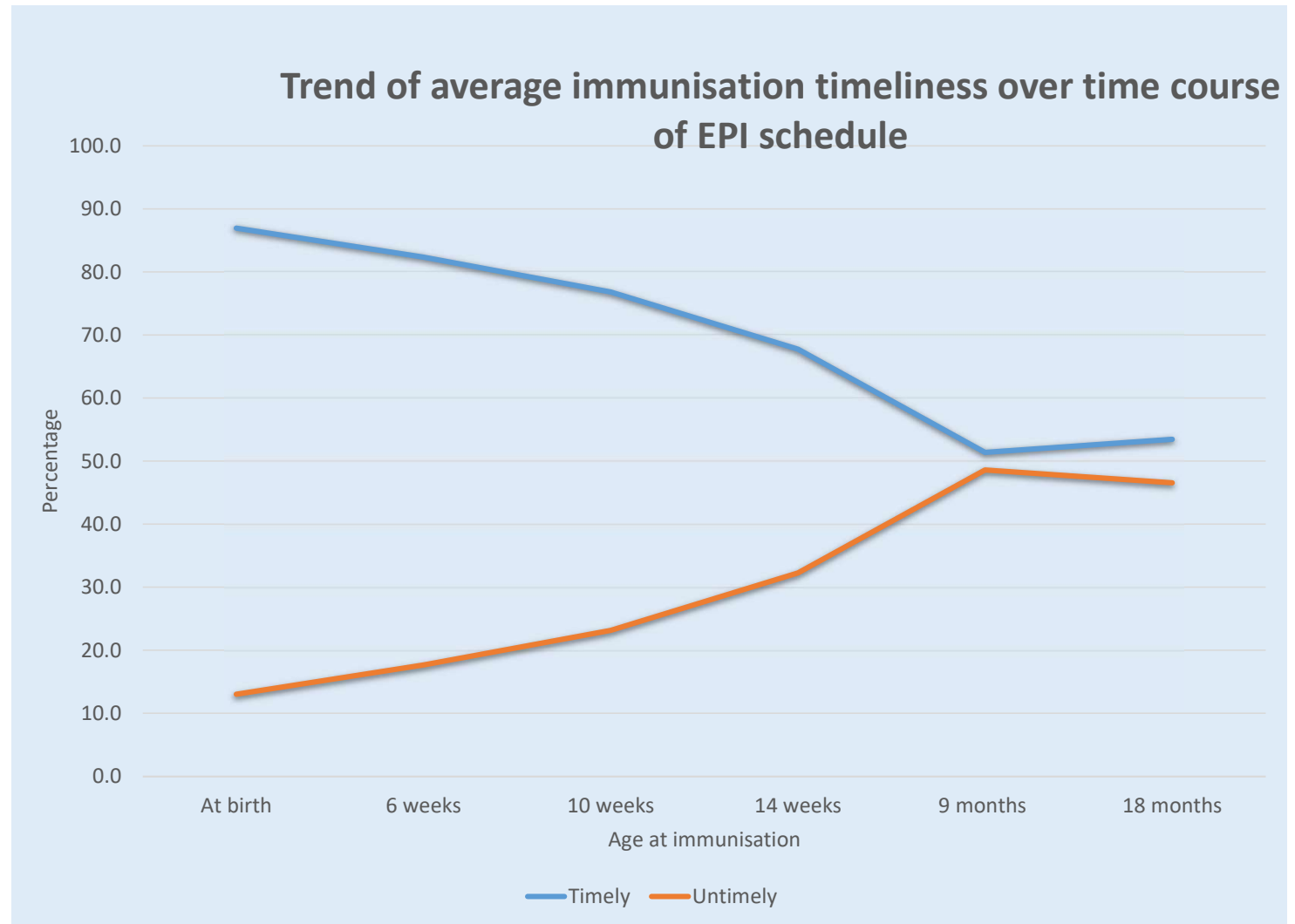
Trend of average immunisation timeliness over time course of EPI schedule

Results (Vaccine-Specific timeliness)

SCHEDULED TIME	VACCINE	Total respondents with documented immunisation	% timely	% untimely
At birth	BCG	410	82.9	17.1
	OPV 0	357	91.0	9
6 weeks	Pentavalent 1	419	82.3	17.7
	PCV 1	419	82.3	17.7
	OPV 1	418	82.5	17.5
	Rotavirus 1	419	82.3	17.7
10 weeks	Pentavalent 2	405	77	23
	PCV 2	405	77.5	22.5
	OPV 2	405	76.8	23.2
	Rotavirus 2	405	76	24.0
14 weeks	Pentavalent 3	348	67.8	32.2
	PCV 3	347	68	32.0
	OPV 3	344	67.4	32.6
9 months	MR 1	147	53.1	46.9
	YF	145	49.7	50.3
18 months	MR 2	30	53.3	46.7
	Men A	28	53.6	46.4

Timeliness of vaccine antigens (categorical)

Vaccine antigen	mean difference (in days) between scheduled date and actual date of immunisation
BCG	8.7
OPV 0	5.4
Pentavalent 1	5.2
Pneumococcal 1	5.2
OPV1	5.2
Rotavirus 1	5.2
pentavalent 2	9.9
pneumococcal 2	9.9
OPV 2	10.1
Rotavirus 2	10.3
pentavalent 3	15.2
pneumococcal 3	15.2
OPV 3	15.4
MR 1	15.8
YF	22.8
MR 2	26.6
Men A	28.2

Timeliness of vaccine antigens (continuous)

Results

OPV-0 Vaccine

n = 357

**No significant associations seen for BCG

Variable (independent)	Odds ratio	Confidence Interval (95%)	P-Value
Educational Status of Caregiver Educated/ no education	1.658	0.915 -3.005	0.093
Employment (Employed/ Unemployed)	1.358	0.755 – 2.442	0.306
Gestational Age (preterm/ term)	0.734	0.406-1.329	0.306
Gender of Infant (male/ female)	0.691	0.411 -1.161	0.161
Birth Weight (low/ normal)	0.355	0.185-0.680	0.001
Place of delivery (health facility/home)	3.313	1.237 – 8.874	0.020
Parity (low/high)	1.625	0.624 – 4.232	0.403
Attendance to more than one different immunisation clinic in the past year (yes/No)	1.401	0.699 – 2.808	0.340
Belief in the necessity to comply with scheduled immunisation time (yes/No)	1.199	0.132 – 10.895	1.000
Belief that vaccines are protective(yes/No)	0.827	0.791 – 0.865	1.000
Belief that peers are compliant with immunisation schedule (yes/No)	1.184	0.497 – 2.822	0.703
Previous Vaccine Hesitancy (yes/No)	2.367	0.544 – 10.306	0.400

factors affecting timeliness of immunisation (At Birth)

Results

6th Week n = 419	Variable (independent)	Odds ratio	Confidence Interval (95%)	P-Value
	Educational Status * of Caregiver Educated/ no education	1.761	0.991 – 3.128	0.051
	Birth Weight (low/ normal)	0.659	0.333-1.304	0.229
	Place of delivery (health facility/home)	3.669	1.422 -9.471	0.010

10th Week n = 405	Variable (independent)	Odds ratio	Confidence Interval (95%)	P-Value
	Educational Status of Caregiver Educated/ no education	2.476	1.458 – 4.206	0.001
	Birth Weight (low/ normal)	0.429	0.235-0.785	0.005

14th Week N= 348	Variable (independent)	Odds ratio	Confidence Interval (95%)	P-Value
	Educational Status of Caregiver Educated/ no education	3.852	2.195 – 6.761	0.000
	Birth Weight (low/ normal)	0.55	0.299-1.012	0.053
	Place of delivery (health facility/home)	5.156	1.307 -20.330	0.015

NB: number for 9th and 18th months low

*education status defined for formal education

factors affecting timeliness of immunisation   at 6th, 10th and 14th weeks

Results (LBW/ Preterms)

KEY FINDINGS

- **Total born premature : 94 (22.3%)**
  - No evidence of gestational age at birth for 26 (6.2%) of infants

- **Total LBW : 57 (13.5%)**
  - No evidence of birth weight for 20 (4.8%) of infants

- **Significant associations noted only for *LBW***
  - and only at birth and at 10 weeks immunisation
  - Prematurity effect ??

Time of immunization	Variable (independent)	Odds ratio	Confidence Interval (95%)	P-Value
Birth (BCG) N= 410	Gestational Age Preterm/ Term	0.875	0.157-4.874	0.879
	Birth Weight Low birth weight/ Normal birth weight	2.769	0.252-30.83	0.390
Birth (OPV-0) N= 357	Gestational Age Preterm/ Term	0.734	0.406-1.329	0.306
	Birth Weight Low birth weight/ Normal birth weight	0.355	0.185-0.680	**0.001**
6 weeks (n =419)	Gestational Age Preterm / Term	0.590	0.336-1.036	0.064
	Birth Weight Low birth weight /Normal birth weight	0.659	0.333-1.304	0.229
10 weeks N =405	Gestational Age Preterm / Term	0.617	0.364-1.044	0.071
	Birth Weight Low birth weight Normal birth weight	0.429	0.235-0.785	**0.005**

preterm birth / LBW and timeliness

Conclusion

- High coverage rates but significant challenges with timeliness
  - Delayed immunizations in as much as 50.3% (for YF)

- Major factors : low (formal) educational status , LBW and "home" births

- Timeliness decreasing with age
  - Demand side versus supply side?
  - static versus outreach ?

- Documentation challenges or missed opportunities ?
  - Significant number not immunised or having <u>no record</u> of immunization worrying
    (as many as 11 and 64 children had no documentation for BCG and OPV-0 respectively)
  - Problem with recording preterm births? More documentation, less recall

- Monitoring timeliness alongside coverage rates will help <u>improve outcomes and promote resilience</u>
  - Knowledge of baseline timeliness and associated factors will help prepare and contain health system shocks (such as COVID)