



Row-Per-Record Reports in Longitudinal REDCap Projects

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A Wide ("Classic") REDCap Project

Consider a trial with multiple visits

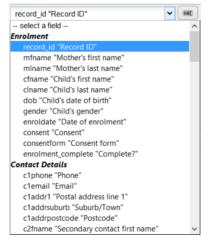
Data	Collection Instruments:
Enr	olment
Cor	ntact Details
Rar	nd Visit Admin
Rar	ndomisation
MO3	3 Questionnaire
MO	Questionnaire
MO	Visit Admin
MO	3 Visit
MOS	Questionnaire
M12	2 Questionnaire
M12	2 Visit Admin
M12	2 Visit
Adr	nin And Study End

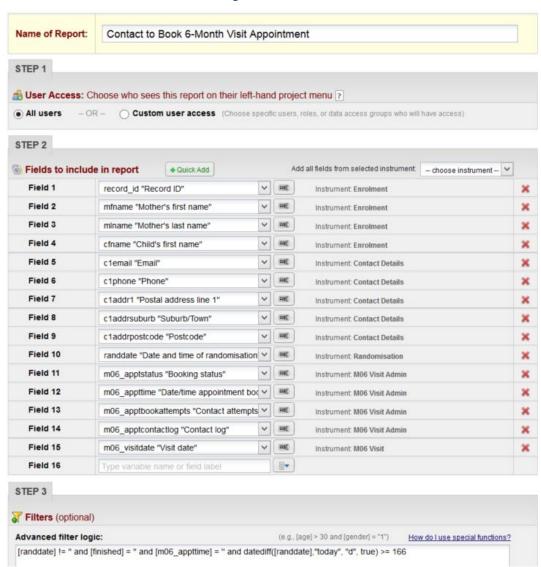
Record ID	Enrolment	Contact Details	Rand Visit Admin	Randomisation	M03 Questionnaire	M06 Questionnaire	M06 Visit Admin	M06 Visit	M09 Questionnaire	M12 Questionnaire	M12 Visit Admin	M12 Visit	Admin And Study End
1001	•	•	•	•	•	•	•	•	•	•	•	•	•
1002	•	•	0	0	0	0	0	0	0	0	0	0	
1003	•	•	•	•	•	•	•	•	•	0	•	•	0
1004	•	•	•	•	•	•	•	•	•	0	•	•	0
1005	•	•	•	•	0	•	•	•	•	0	0	0	0
1006	•	•	•	•	•	•	•	•	•	0	0	0	0
1007	•	•	•	•	•	•	•	•	•	0	0		0
1008	•	•	•	•	•	0	•	•	•		0	0	0
1009	•	•	•	•	0	•	•	•	•	0	0	0	0
1010	•	•	•	•	•	•	•	•	•	0	0	0	0
1011	•	•	•	•	•	0	0	0	•	0	0	0	•
1012	•	•	•	•	•	•	•	•	•	0	0	0	0
1013	•	•	•	•	•	•	•	•	•	0	0	0	0
1014	•	•	•	•	•	•	•	•	•	0	0	0	0
1015	•	•	•	•	•	•	•	•	0	0	0		•

- Forms and variables created "wide", e.g. for visit dates: [rnd_visitdate], [m06_visitdate], [m12_visitdate]
- We want to contact participants due for 6-month visit to book appointment...

Data Exports/Reports in Wide Projects

- Create a report listing participant details
 - Not withdrawn
 - Not yet booked in
 - >= 166 days from randomisation
- Select fields by name





[randdate] != " and [finished] = " and [m06_appttime] = " and datediff([randdate],"today", "d", true) >= 166

Data Exports/Reports in Wide Projects

Run and view the report



Export for mail merge, phone list, upload to SMS provider



A Longitudinal REDCap Project

Use longitudinal data collection with repeating forms?

Longitudinal model enables

Repeating data entry forms (and so repeating variables e.g. [visitdate])

Data Collection Instrument	Enrolment	Randomisation (2)	3-month Questionnaire	6-month Visit	9-month Questionnaire	12-month Visit	of Study (7)
Enrolment	✓						
Contact Details	4						
Randomisation		4					
Questionnaire (survey)			~	4	✓	4	
Visit Admin		4		4		4	
Visit		4		4		4	
Admin And Study End							4

Schedule of events

		Event #	Days Offset	Offset Range Min / Max	Event Name	Unique event name (see (auto-generated)
0	×	1	-14	-0/+0	Enrolment	enrolment_arm_1
0	×	2	0	-0/+0	Randomisation	randomisation_arm_1
0	×	3	90	-0/+0	3-month Questionnaire	3month_questionnai_arm_
0	×	4	180	-0/+0	6-month Visit	6month_visit_arm_1
0	×	5	270	-0/+0	9-month Questionnaire	9month_questionnai_arm_1
0	×	6	360	-0/+0	12-month Visit	12month_visit_arm_1
0	×	7	9999	-0/+0	End of Study	end_of_study_arm_1

Participant grid view

Record ID 1057

Data Collection Instrument	Enrolment	Randomisation (2)	3-month Questionnaire (3)	6-month Visit (4)	9-month Questionnaire (5)	12-month Visit (6)	end of Study (7)
Enrolment	•						
Contact Details	•						
Randomisation		•					
Questionnaire (survey)			•	0	0	0	
Visit Admin		•		•		0	
Visit		•		(6)		0	
Admin And Study End							0

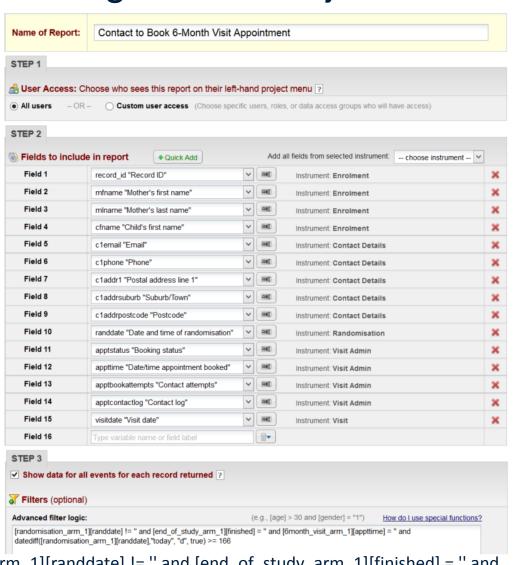
So far so good…

Calendar view



Data Exports/Reports in Longitudinal Projects

- Create the same report as before
 - Not withdrawn
 - Not yet booked in
 - >= 166 days from randomisation
- Field names unique only within event, not project
 - Event prefixes in filter expression



[randomisation_arm_1][randdate] != " and [end_of_study_arm_1][finished] = " and [6month_visit_arm_1][appttime] = " and datediff([randomisation_arm_1][randdate],"today", "d", true) >= 166

The Problem

- Same fields, but format is not so useful
 - Row-per-participant-per-event
 - Row for each event for which the record has data even if you're not interested in it (e.g. [apptstatus] for randomisation)

Contact to Book 6-Month Visit Appointment

Record ID (record_ id)	Event Name (redcap_ event_name)	Mother's first name (mfname)	Mother's last name (mlname)	Child's first name (cfname)	Email (c1email)	Phone (c1phone)	Postal address line 1 (c1addr1)	Suburb/Town (c1addrsuburb)	Postcode (c1addrpostcode)	Date and time of randomisation (randdate)	Booking status (apptstatus)	Date/time appointment booked (appttime)	Contact attempts (apptbookattempts)
1057	Enrolment	Rhonda	Holloway	Belle	RHolloway@example.com	04 1057 1057	787-6676 Eget St.	Abingdon	7323				
1057	Randomisation									16-02-2015 12:16:09	Succeeded - appointment made (1)	16-02-2015 10:00	2 (2)
1057	3-month Questionnaire												
1057	6-month Visit										In progress		1 (1)
1057	End of Study												
1058	Enrolment	Aileen	Mcfadden	Karyn	AMcfadden@example.com	04 1058 1058	870-3650 Ac Avenue	Fahler	2965				

- Requires further manipulation to use
 - Mail-merge
 - Upload to SMS provider

Why is it like this?

- Entity-Attribute-Value (EAV) model
 - Frowned upon by relational database purists but similarities with key-value store NoSQL database systems
 - Common model for CMS, health (e.g. EMR), research systems
 - Enables flexibility in data definition
 - Easy to get data in, but harder to get data out than with traditional relational database schema

Entity (project/event/record)

Attribute (field_name)

Value

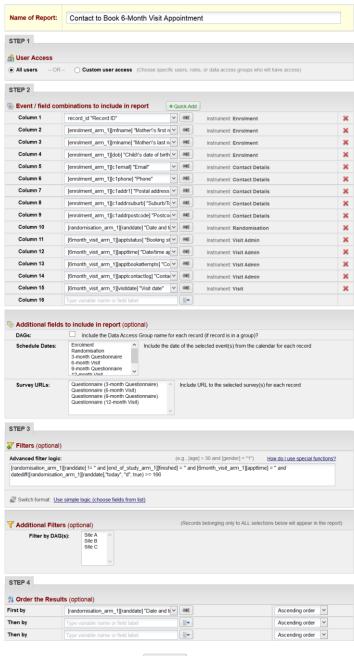


A Solution: "Longitudinal Reports" Plugin

- "Reshape" the EAV data from "long" to "wide"
 - Rows (entities): participant/event => participant
 - Columns (attributes): fields => event/field
 - Not replacing "official" export functionality leave out plots/charts and stats package syntax
- Option 1: extend existing plugin for running SQL query
 - Relatively quick and easy to produce something simple
 - Difficult to reproduce more advanced features
- Option 2: adapt official Data Export & Reports module
 - Much bigger job: 20 files, around 7000 lines of code
 - Interface familiar to users
 - Important functionality (e.g. DAGs, view/export permissions, de-identification) already present

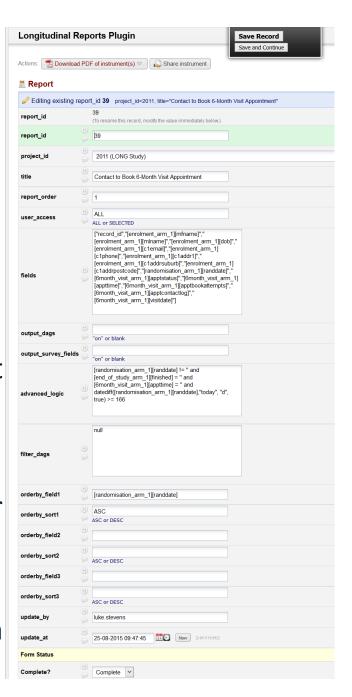
Plugin Development: Front End

- Familiar layout and functionality
 - User access options
 (e.g. restrict by DAG, role or user)
 - Event/field selection as columns (including Quick Add)
 - Simple or advanced filter logic (including by DAG)
 - Record sorting options
 - De-identification on export
- All columns [event_ref][field_name]
- Additional functionality
 - Include dates from event schedule
 - Include survey urls



Plugin Development: Back End

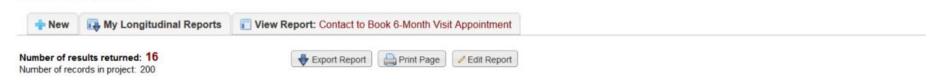
- Configuration of reports stored in a dedicated REDCap project
 - Options stored as text (e.g. sort field/order)
 - Lists (e.g. of events/fields to include stored as serialised arrays)
 - Audit trail store update by, update at
- Records updated using REDCap API
 - Insert new record on report creation
 - Update record on report edit (re-order list requires multiple updates)
 - Delete can't delete using API, so update project_id to this configuration project's id (easy to restore!)



Plugin Development: Results

• It works!
Row-per-participant reports of your longitudinal data:

Longitudinal Reports



Contact to Book 6-Month Visit Appointment

Record ID record_ id	Mother's first name Enrolment [enrolment_ arm_1] [mfname]	Mother's last name Enrolment [enrolment_ arm_1] [mlname]	Child's date of birth Enrolment [enrolment_arm_1] [dob]	Email Enrolment [enrolment_arm_1] [c1email]	Phone Enrolment [enrolment_arm_1] [c1phone]	Postal address line 1 Enrolment [enrolment_arm_1] [claddr1]	Suburb/Town Enrolment [enrolment_ arm_1] [c1addrsuburb]	Postcode Enrolment [enrolment_arm_ 1] [claddrpostcode]	Date and time of randomisation Randomisation [randomisation_ arm_1] [randdate]	Booking status 6-month Visit [6month_ Visit_arm_1] [apptstatus]	Date/time appointment booked 6-month Visit [6month_ visit_arm_1] [appttime]	Contact atter 6-month Visit [6month_visit 1] [apptbookatte
1057	Rhonda	Holloway	13/04/2014	RHolloway@example.com	04 1057 1057	787-6676 Eget St.	Abingdon	7323	16-02-2015 12:16:09	In progress		1 (1)
2038	Angelica	Adkins	12/05/2012	AAdkins@example.com	04 2038 2038	P.O. Box 845, 4539 Pharetra Rd.	Pointe-au-Pic	7789	17-02-2015 21:24:20			
						1940						

	Α	В	C	D	E	F	G	Н	1	J	K	L
		[enrolment	[enrolment	[enrolment					[enrolment		[6month_visit	
		_arm_1]	_arm_1]	_arm_1]	[enrolment_arm_1]	[enrolment_arm_1]	[enrolment_arm_1]	[enrolment_arm_1]	_arm_1]	[randomisation_arm_1]	_arm_1]	[6month_visit
1	record_id	[mfname]	[mlname]	[dob]	[c1email]	[c1phone]	[c1addr1]	[c1addrsuburb]	[c1addrpost	[randdate]	[apptstatus]	[appttime]
2	1057	Rhonda	Holloway	13/04/2014	RHolloway@example.com	04 1057 1057	787-6676 Eget St.	Abingdon	7323	16/02/2015 12:16	0	
3	2038	Angelica	Adkins	12/05/2012	AAdkins@example.com	04 2038 2038	P.O. Box 845, 4539 Pl	Pointe-au-Pic	7789	17/02/2015 21:24		
4	2039	Vera	Langley	13/06/2014	VLangley@example.com	04 2039 2039	Ap #421-4246 Aliquar	Morpeth	4919	18/02/2015 06:54		

Acknowledgements

- Feedback
 - "A very exciting development"
 - "Worked just fine. So much better"
 - "loving it!!!"
- Thanks to
 - The REDCap team at Vanderbilt (naturally!)
 - Kaya Gardiner and Veronica Abruzzo (MIS BAIR Project, MCRI), for beta testing and constructive comments
 - Naveen Karduri (Child & Family Research Institute/BC Children's Hospital), for testing, constructive comments and code contributions
- Interest in seeing this in the REDCap wiki Plugin Library?