Measuring vaccine confidence or vaccine hesitancy –
An overview of measures, challenges, and opportunities

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understand

use

Social and individual aspects of health and medical
decision making - Research @University of Erfurt

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Intelligence is … what an intelligence test measures

Boring, 1923

Some definitions – the words we use

- **Vaccine hesitancy (the roof** - MacDonald et al., 2015)
  - delay in acceptance or refusal of vaccination despite availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place and vaccines. It is influenced by factors such as **complacency, convenience and confidence.**
- **Vaccine confidence (the thinking and feeling**- MacDonald et al., 2015)
  - trust that parents or health-care providers have (*1*) in the recommended immunizations, (*2*) in the provider(s) who administers vaccines, and (*3*) in the process that leads to vaccine licensure and the recommended vaccination schedule.
- **Vaccine demand (the taking action** – SAGE WG SO2, 2017)
  - actions of individuals and communities to seek, support and/or advocate for vaccines and vaccination services, … fostered by governments, immunization programme managers, public and private sector providers, local leadership and civil society organizations hearing and acting on the voices of individuals and communities.
- **Vaccine acceptance (the behaviour** - Orenstein et al., 2015)
  - the timely receipt of all childhood vaccines as recommended when vaccines and vaccine services are available.
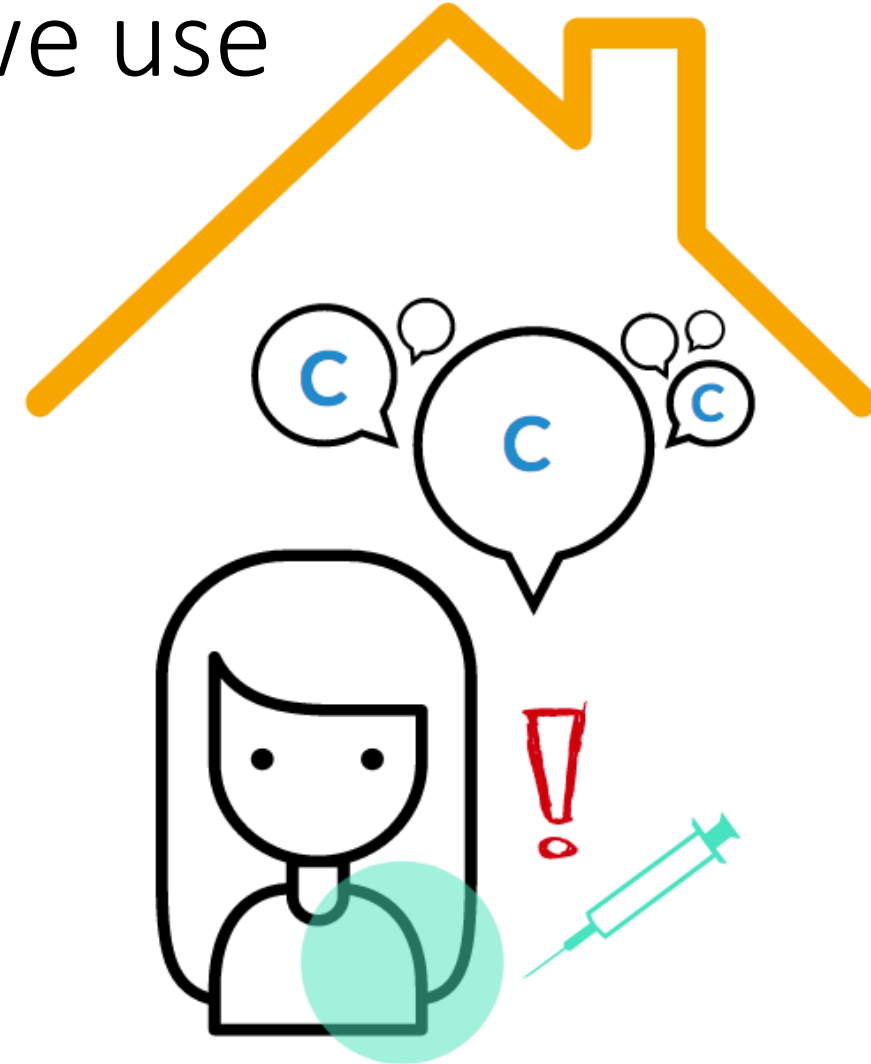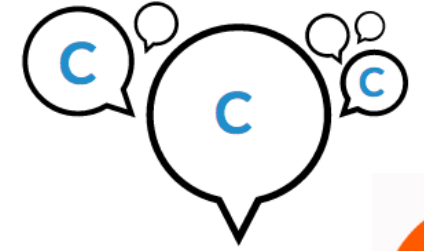
The 3 C Model of vaccine hesitancy

- Confidence
  - trust in effectiveness and safety of vaccines and the system that delivers them (health care workers, politics)

- Convenience (aka Constraints)
  - physical availability, affordability and willingness-to-pay, geographical accessibility, ability to understand (language and health literacy) and appeal of immunization service

- Complacency
  - perceived risks of diseases are low; vaccination not seen as necessary, lack of knowledge, no will-power

confidence

constraints

complacency

MacDonald et al., 2015

Extension of the 3C model: 5Cs
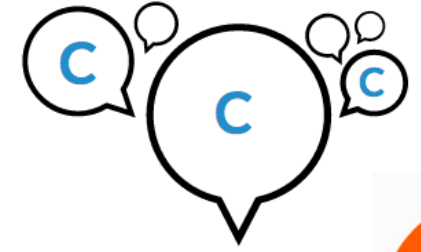
- Calculation
  - individuals' engagement in extensive information search
- Collective responsibility
  - the willingness to protect others by one's own vaccination by means of herd immunity; the flip-side is the willingness to free-ride when enough others are vaccinated

More definitions:

- **Antecedents of vaccination** (Brewer et al., 2018; Betsch et al., 2018)
  - What we feel or think about vaccination, barriers and enablers, factors such as confidence, convenience, complacency, calculation, collective responsibility – and others.
  - Psychological representations of the world around us
    - E.g., access problems create perceived barriers

confidence

constraints

complacency

calculation

collective responsibility

Betsch et al., 2018

vaccine hesitancy

vaccine confidence

… as a mental representation

on an individual level!

Overview of scales

- a screening of the „market"

Behavioural Insights Summer School (2018)

Betsch et al., 2018 (https://psyarxiv.com/ytb7w/)

Parental attitudes towards vaccination PACV

15 items
3 sub-scales
Childhood vaccination

Find the scale here:

Opel and colleagues (2013). The relationship between parent attitudes about childhood vaccines survey scores and future child immunization status: a validation study. JAMA Pediatr. 2013;167: 1065–1071.

confidence

World Health Organization
REGIONAL OFFICE FOR **Europe**

UNIVERSITÄT ERFURT

What PACV measures

Subscales and *sample items*:

Beliefs about safety and efficacy: *How concerned are you that your child might have a serious side effect from a shot?*

General attitudes and trust: *Overall, how hesitant about childhood shots would you consider yourself to be?*

Immunization behavior: *Have you ever decided not to have your child get a shot for reasons other than illness or allergy?*

Vaccine Confidence Scale VCS

8 items
3 sub-scales
Teenager vaccination (13 to 17-years)

Find the scale here:

Gilkey and colleagues (2014). The Vaccination Confidence Scale: a brief measure of parents' vaccination beliefs. Vaccine. 2014;32: 6259–6265.

confidence

World Health Organization
REGIONAL OFFICE FOR **Europe**

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What VCS measures

Subscales and *sample item:*

Benefits: *Vaccines are safe.*

Trust: *In general, medical professionals in charge of vaccination have my teenager's best interest in heart.*

Harms: *Teenagers receive too many vaccines.*

Global vaccine confidence index GVCI

4 items
no sub-scales
Vaccination in general

Find the scale here:

Larson and colleagues (2016). The State of Vaccine Confidence 2016: Global Insights Through a 67-Country Survey.
EBioMedicine. 2016;12: 295–301.

2016 data of 67 countries at www.vaccineconfidence.org

confidence

complacency

World Health Organization
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What GVCI measures

Subscales and *sample item:*

Safety: *Overall I think vaccines are safe.*

Effectiveness: *Overall I think vaccines are effective.*

Importance: Vaccines are important for children to have.

Compatibility with religious beliefs: *Vaccines are compatible with my religious beliefs.*

5C psychological antecedents of vaccination

5 or 15 items
5 sub-scales
vaccination in general

Find the scale here:

Betsch and colleagues (submitted). Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination. Available at: https://psyarxiv.com/ytb7w

confidence

constraints

complacency

calculation

collective responsibility

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What 5C measures

Subscales and *sample items*:

Confidence: *I am completely confident that vaccines are safe.*

Constraints: *Everyday stress prevents me from getting vaccinated.*

Complacency: *Vaccination is unnecessary because vaccine-preventable diseases are not common anymore.*

Calculation: *When I think about getting vaccinated, I weigh benefits and risks to make the best decision possible.*

Collective responsibility: *When everyone is vaccinated, I don't have to get vaccinated, too.*

construct	Parental Attitudes towards Childhood Vaccination PACV (Opel)	Vaccine Confidence Scale VCS (Gilkey)	Global vaccine confidence index GVCI (Larson)	Vaccine Hesitancy Scale VHS (Shapiro)	Vaccine acceptance Scale VAS (Sarath-chandra)	5C antecedents of vaccine acceptance 5C (Betsch)
confidence	⭕	⭕	⭕	⭕	⭕	⭕
constraints						⭕
complacency			⭕			⭕
calculation						⭕
Collective responsibility						⭕
Compatibility with religious beliefs			⭕			

Betsch et al., 2018 (https://psyarxiv.com/ytb7w/)

Creating a new measure menas to establish construct validity

Trust in institutions r = .32

attitude r = .78

confidence

Trust in providers r = .46

Betsch et al., 2018

Table 2. Relations between 5C sub-scales and validation constructs.

	Confidence	Constraints	Complacency	Calculation	Collective responsibility
Vaccination behavior	(+)	(-)	(-)	(-)	(+)
Intention to vaccinate	(+)	(-)	(-)	(-)	(+)
Study 1	attitude (+)	perceived behavioral control (-)	risk attitude (+)	risk attitude (-)	
	knowledge (+)	self-efficacy (-)	considering future consequences (-)	numeracy (+)†	
	beliefs about medicine: benefits (+)		perceived risk of disease (-)	perceived risk of disease (-)	
	beliefs about medicine: harms (+)		normative beliefs (-)	perceived risk of vaccination (+)	
	conspiracy mentality (-)				
Study 2	attitude (+)	self-control (-)	perceived threat due to infectious diseases (-)	preference for deliberation (+)	communal orientation (+)
	knowledge (+)	perceived time pressure (+)	perceived personal health status (+)†	superstitious beliefs (-)†	collectivism (+)
	trust in health care systems (provider, payer, institution) (+)	perceived access to health care (-)	invulnerability (+)		individualism (-)†
	conspiracy mentality (-)†				empathy (+)

Note. (+) hypothesized positive relation; (-) hypothesized negative relation. † Correlation did not occur as expected for either the long or short version or both (see Table .

How do the measures relate to each other?

Measures that assess predominantly confidence **correlate highly (ca. r = .70, .80 and higher)**

→ If you want to measure confidence: choose one

N = 350 parents; Mturk sample, 49% women
Betsch et al., 2018

	5C Psychological Antecedents of vaccination	Parental Attitudes towards Childhood Vaccination	Vaccine Confidence Scale (benefit factor)	Global vaccine confidence index	Vaccine hesitancy scale	Vaccine Acceptance	Vaccine Confidence Index
	Betsch 5C	Opel PACV	Gilkey VCS	Larson GVCI	Shapiro VHS	Sarath-chandra VAS	Frew VCI
min. max	[1,7]	[0,30]	[1,11]	[1,5]	[1,5]	[1,7]	[1,5;6;7]
5C Conf. α = .85	.557**	-.674**	.790**	.782**	.800**	-.764**	.828**
5C Constr. α = .85	-.764**	.467**	-.308**	-.254**	-.440**	.547**	-.290**
5C Compl. α = .76	-.781**	.619**	-.477**	-.414**	-.577**	.701**	-.429**
5C Calc. α = .78	-.391**	.272**	-.093	-.084	-.172**	.237**	-.153**
5C Coll. R. α = .71	.759**	-.657**	.751**	.696**	.780**	-.765**	.692**
Total 5C α = .71		-.731**	.609**	.546**	.711**	-.806**	.600**
PACV α = .89			-.721**	-.689**	-.826**	.879**	-.732**
VCS α = .90				.835**	.875**	-.803**	.860**
GVCI α = .87					.823**	-.765**	.831**
VHS α = .90						-.894**	.874**
VAS α = .95							-.804**
VCI α = .95							

# How well do the measures predict vaccination status?

- Going beyond confidence: Measures differ in how good they explain vaccination status
  - US sample
    - Measles uptake (n = 301; parents of children >=2 years)
      - **Ca. 40% of explained variance: VAS, 5C**
      - Ca. 30%: PACV, VCS, VHS
    - HPV uptake (n = 97; parents of children >= 11 year)
      - **Over 35%: 5C**
      - 30%: PACV, GVCI
      - ca.20%: VCS, VHS, VAS
    - Influenza uptake (n = 316)
      - **Above 20%: 5C**
      - Below 20%: VHS, VAS, PACV, GVCI, VCS

Broader measures explain „more" behaviour

Betsch et al., 2018 (https://psyarxiv.com/ytb7w/)

Opportunity: Monitoring

Percent Disagreeing with the Statement, "Overall I think vaccines are safe"

0%   41%
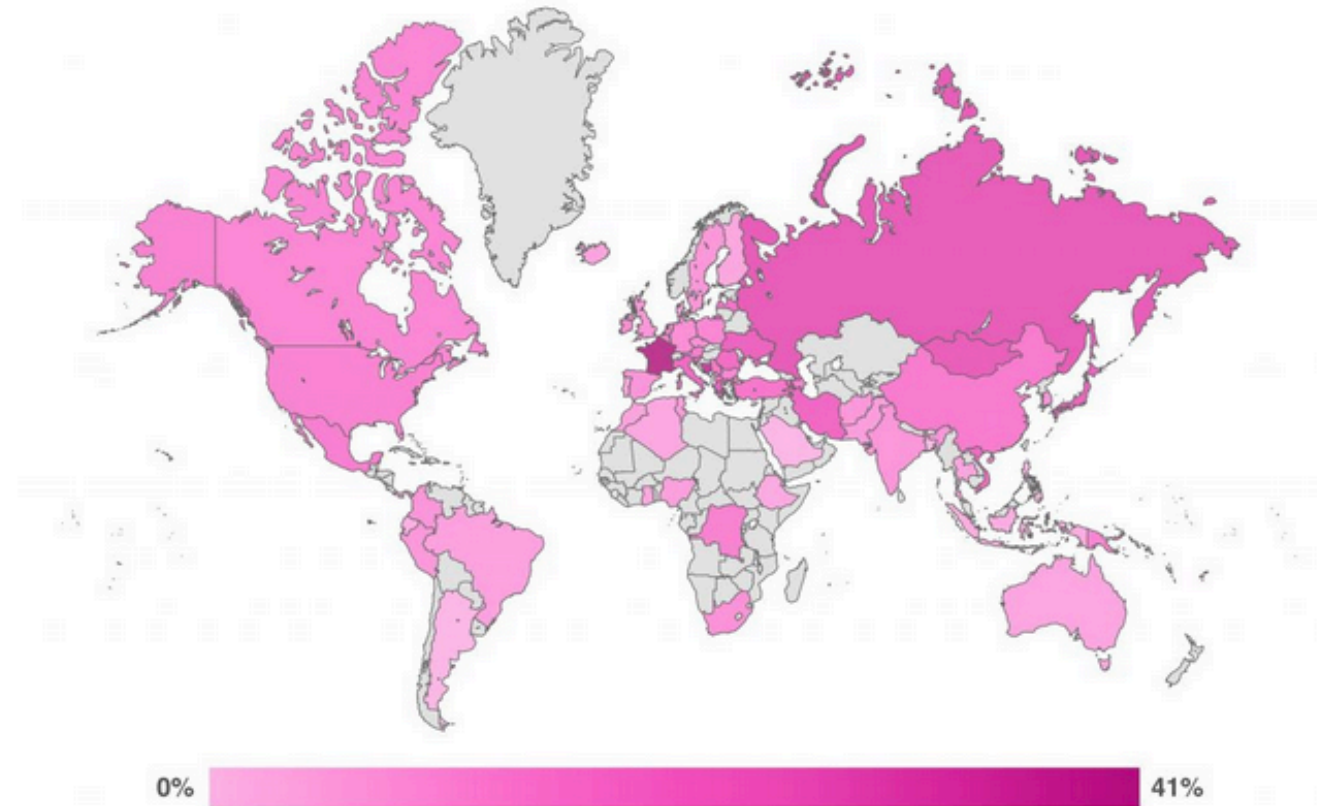
*Highest recorded value was 41%, gradient has been scaled to maximise visibility within this range.
This map represents percentage disagreement with the statement, "Overall I think vaccines are safe," by combining the two disagree responses (Tend to Disagree and Strongly Disagree) and dividing by the total number of responses, including Don't Know/No Response as well as the two Agree options. Countries in grey were not included in this survey.

How to measure vaccine confidence

Global vaccine confidence index GVCI

4 items
no sub-scales
Vaccination in general

Find the scale here:

Larson and colleagues (2016). The State of Vaccine Confidence 2016: Global Insights Through a 67-Country Survey. EBioMedicine. 2016;12: 295–301.

2016 data of 67 countries at www.vaccineconfidence.org

http://www.vaccineconfidence.org/research/the-state-of-vaccine-confidence-2016/

Challenge and opportunity: monitoring

- WHO asks countries to monitor and report *vaccine hesitancy* in their annual joint reporting form (JRF) to monitor changes and trends over time and to detect vaccine concerns early

Vaccine Hesitancy

(Section instructions)

Please fill in all questions. Please provide the reasons for vaccine hesitancy even if it is based on your opinion and no underlying research has been conducted. Please indicate whether or not an assessment has been done. If available, kindly provide the link or reference to the publication/report or attach to this report

6740	What are the top three reasons for hesitancy to accept vaccines according to the national schedule in 2017?	
6750	Is this response based or supported by some type of assessment, or is it an opinion based on your knowledge and expertise?	Based on assessment: ca. 30% of reporting countries
6760	Has there been some assessment (or measurement) of vaccine hesitancy at national or subnational level in the past (<5 years)?	<pick one>
6770	If yes, please specify the type and the year and provide assessment title(s) and reference(s) to any publication/report	

WHO/UNICEF Joint Reporting Form on Immunization   Lane et al., 2018
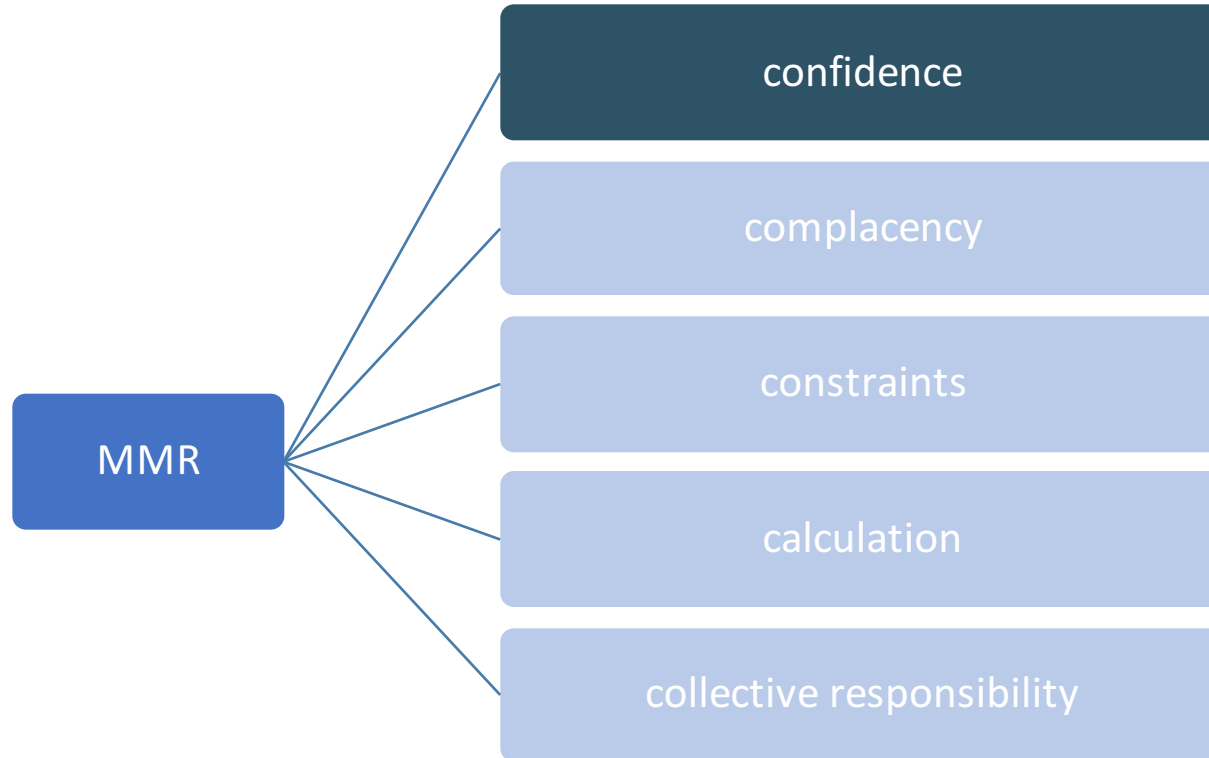
Opportunity: Intervention planning

- Goal: increase vaccine acceptance (influenza, pneumococcal vaccine) for 60+

- Measure: 5C psychological antecedents of vaccination
    - Identified antecendents: confidence, complacency, collective responsibility, calculation
    - More research informed the intervention!

- Intervention: flyers & posters, doctors & pharmacies as multipliers
    - Confidence: adress and debunk myths, explain potential side effects
    - Complacency: explain increased risk of sepsis
    - Collective responsibility: explain herd immunity
    - Calculation: provide information

- Measure: 5C pre-post
    - Identified changes in 5C: none.
    - Self reported vaccine uptake among those who saw the campaign: **influenza + 13%; pneumococcal +11%**
    - Actual vaccine uptake: pending

Betsch, Rossmann et al., 2018

Challenge: adapt to other (cultural) contexts

Nagelkerke's
$R^2 = .19$

MMR

- confidence
- complacency
- constraints
- calculation
- collective responsibility

Having received MMR vaccine (some or all doses) vs. not received. Controlling for age and education. Adeyanju & Betsch, in prep

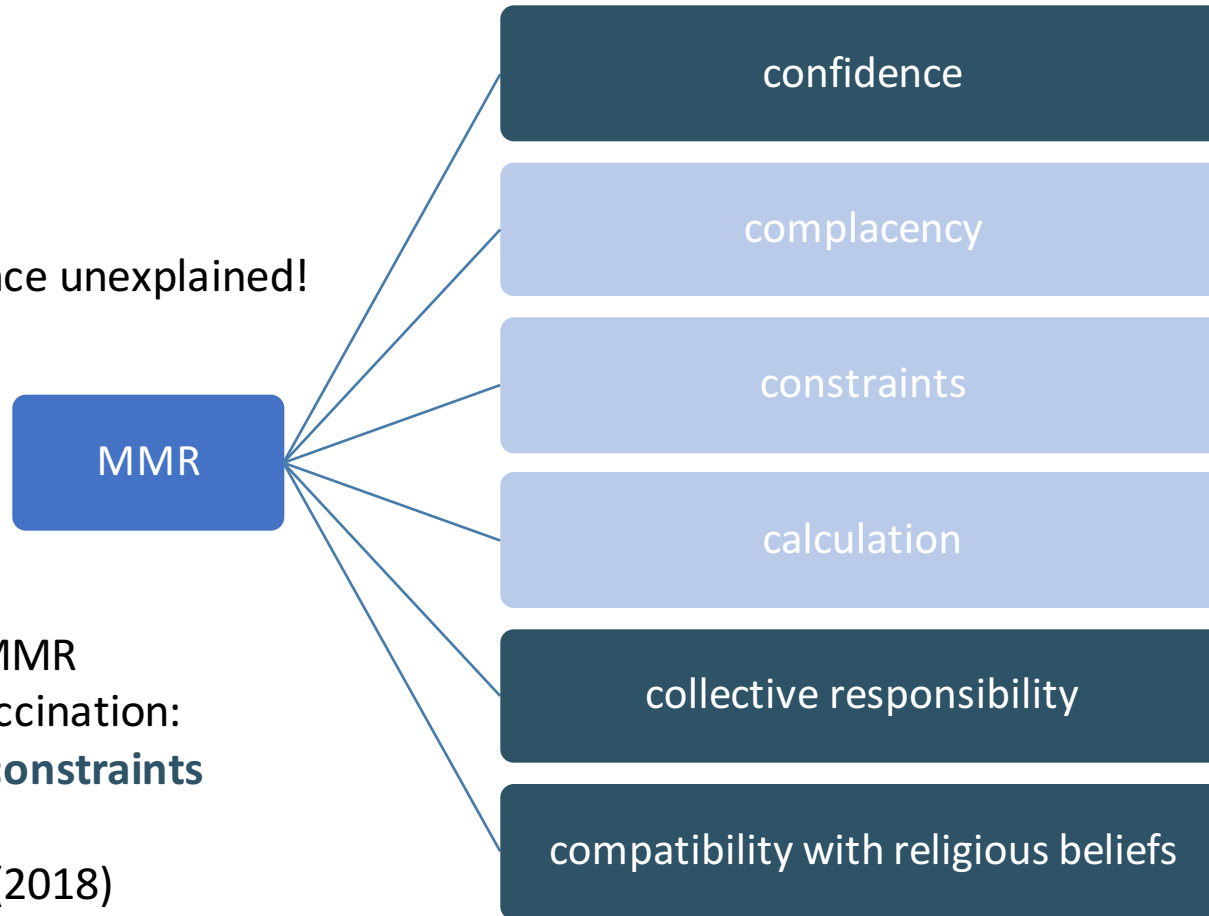# Challenge: adapt to other (cultural) contexts

PRELIMINARY DATA!

Nagelkerke's
R² = . 25

Lots of variance unexplained!

MMR

confidence

complacency

constraints

calculation

collective responsibility

compatibility with religious beliefs

US Sample, MMR
childhood vaccination:
calculation, constraints
(R² = 40%)
Betsch et al. (2018)

Having received MMR vaccine (some or all doses) vs. not received. Controlling for age and education. Adeyanju & Betsch, in prep

# Summary: Measures, opportunities, challenges

- **Measures**
  - There are various scales that measure vaccine hesitancy, confidence, acceptance, vaccine antecedents …
  - Most of the existing scales measure confidence
  - Intercorrelations of the total scores are relatively high, but:
    - Scope varies (e.g. adult, childhood vaccines)
    - Ability to predict vaccine uptake varies
    - Confidence is not always the issue!

- **Challenges**
  - The scale(s) may miss important issues
    - „Garbage in, garbage out"
  - Cultural differences
  - Different relevant antecedents per vaccine

- **Opportunities**
  - Monitoring, intervention planning and evaluation, screening
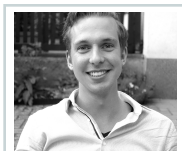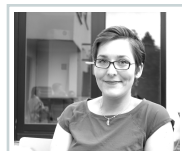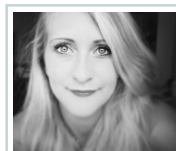 - Vision: Online hub for sharing data

- ✓ Monitoring
- ✓ Comparison
- ✓ Synthesis
- ✓ Diagnosis
- ✓ Interventions
- ✓ Evaluation
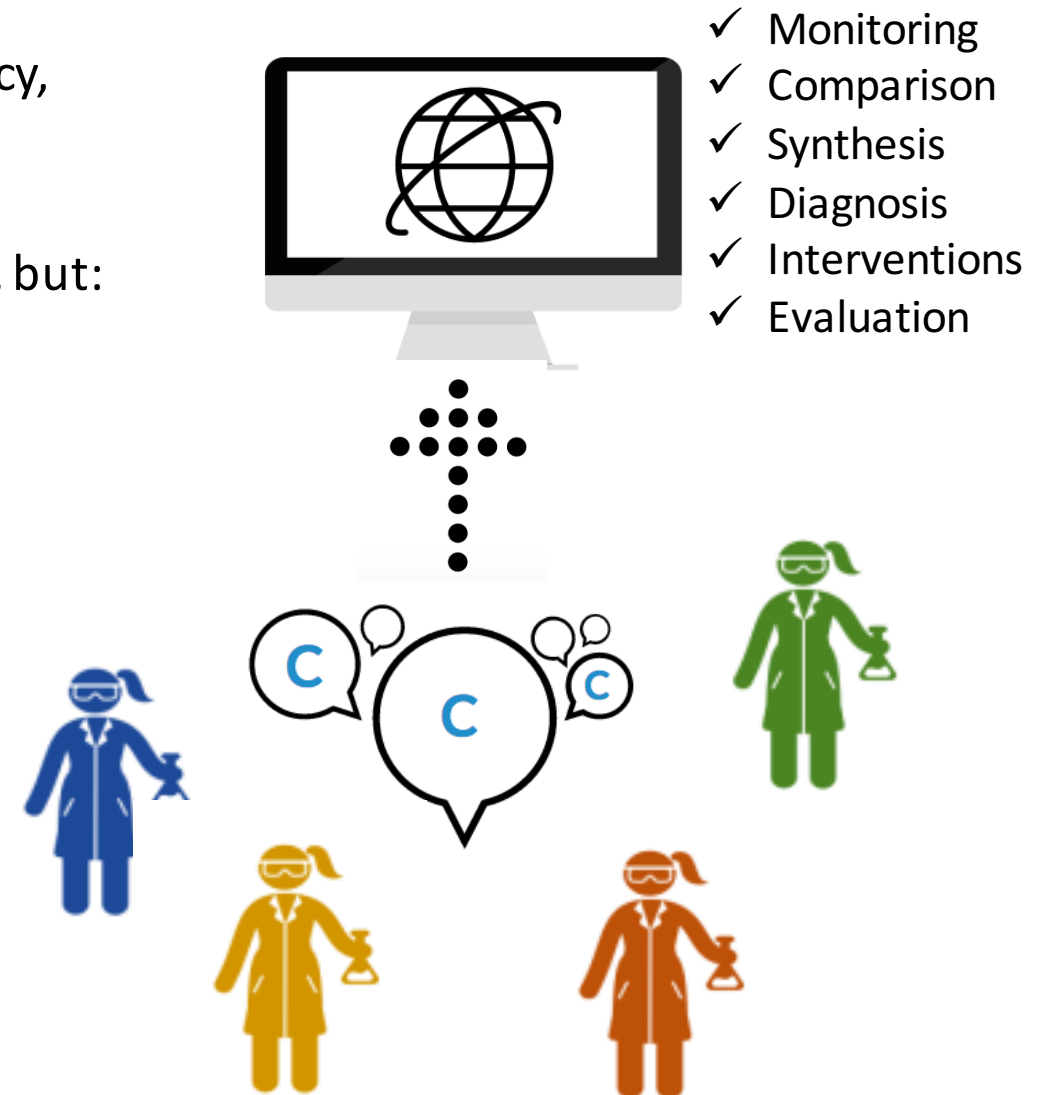
Thank you for your attention

Science knows no country, because knowledge belongs to humanity and is the torch that illuminates the world. Pasteur

Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination

Cornelia Betsch, Philipp Schmid, Dorothee Heinemeier, Lars Korn, Cindy Holtmann, Robert Böhm

Seite: 1 von 56   Automatischer Zoom

Short title: Measuring the psychological antecedents of vaccination   1

Beyond confidence:

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Abstract

Background. Monitoring the reasons why a considerable number of people do not receive recommended vaccinations allows identification of important changes and trends over time, and designing and evaluating strategies to address vaccine hesitancy and increase vaccine uptake. Existing measures assessing such reasons focus primarily on confidence in ...

See more

Preprint DOI

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