Principal Indicators to Monitor Sustainable Development Goals

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History of sustainable development

- "Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

  ——1987 Brundtland Commission Report

- In 2000, the United Nations issued Millennium Development Goals (MDGs) which focuses the sustainable development into eight chapters.

Source: https://www.youtube.com/watch?v=iU0LrTe0uDw
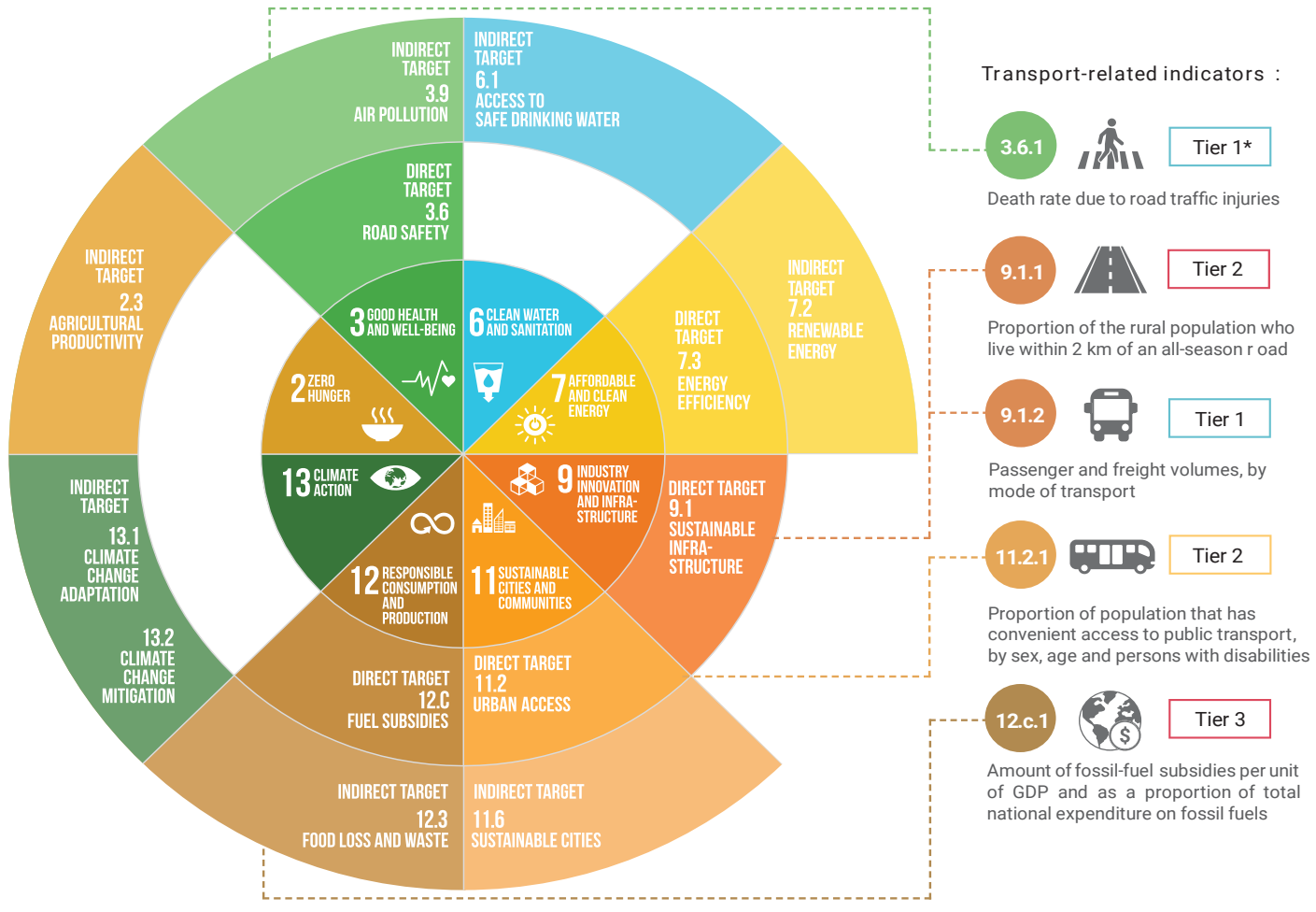

Source: https://www.sumivector.com/news/what-have-the-un-millennium-development-goals-achieved-whats-next-post-2015

Sustainable Development Goals

- In 2015, the United Nations set 17 Sustainable Development Goals (SDGs).

- SDGs act as a universal call to eliminate poverty, protect the environment, and ensure peace and prosperity for all people and the planet.

Source: https://sdgs.un.org/goals

Hierarchical SDGs

Transport-related indicators :

- 3.6.1 — Tier 1*
  Death rate due to road traffic injuries
- 9.1.1 — Tier 2
  Proportion of the rural population who live within 2 km of an all-season r oad
- 9.1.2 — Tier 1
  Passenger and freight volumes, by mode of transport
- 11.2.1 — Tier 2
  Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities
- 12.c.1 — Tier 3
  Amount of fossil-fuel subsidies per unit of GDP and as a proportion of total national expenditure on fossil fuels

■ Each SDG is underpinned by targets.
  ✓ For example, the first target of SDG 9 is "*Develop quality, reliable, sustainable and resilient infrastructure…*".

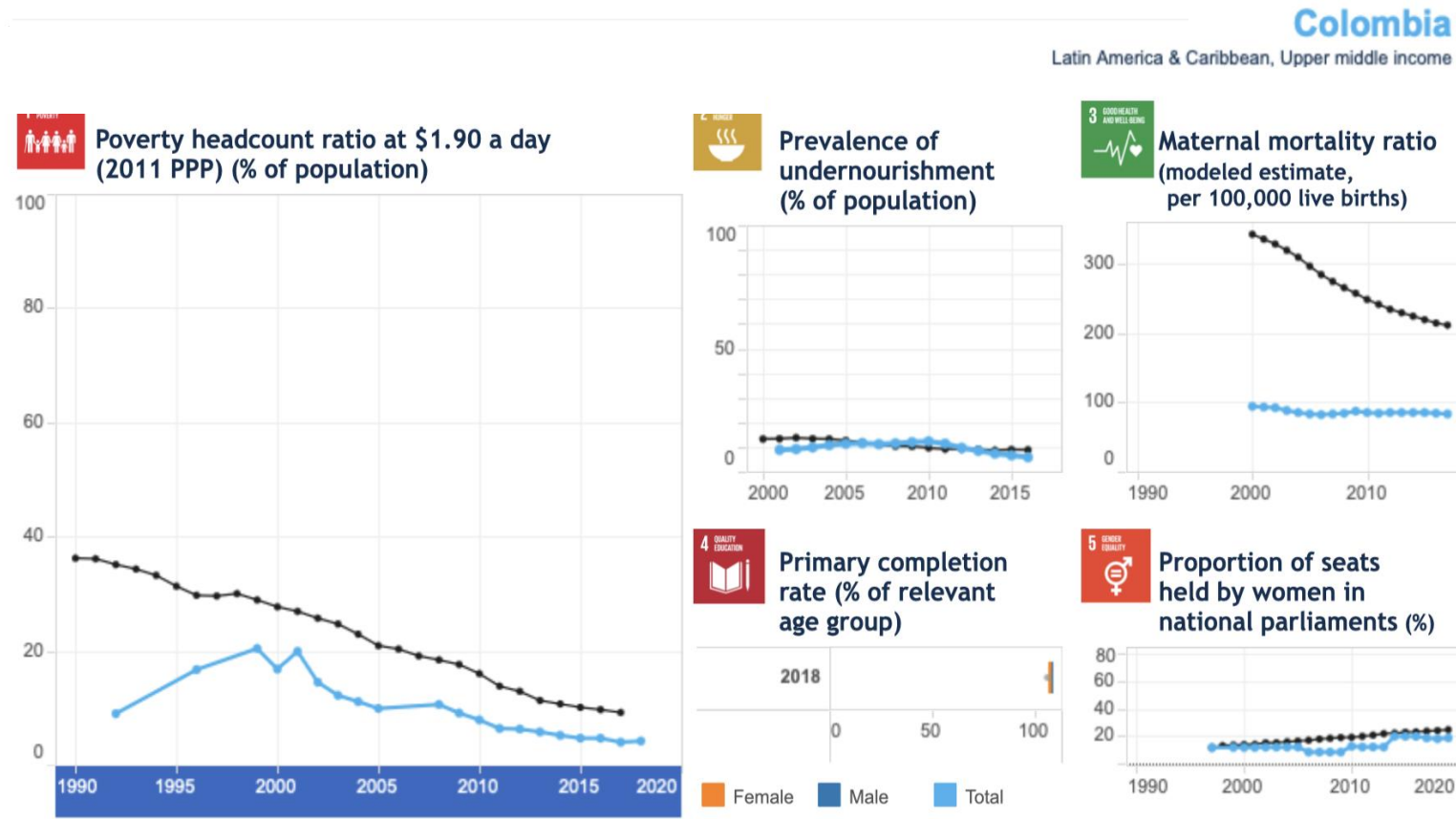■ Each SDG target is measured by measurable SDG indicators.
  ✓ For example, the first indicator of SD target 9.1 is "*Proportion of the rural population who live within 2 km of an all-season road*".

Source: https://slocat.net/our-work/2030-agenda-sdgs/

Leave no one behind

World Development Indicator
Sustainable Development Goals

Colombia
Latin America & Caribbean, Upper middle income

Source: https://datatopics.worldbank.org/sdgs/SDG-selected-indicators.html

- Leave no one behind is the central promise of the 2030 Agenda for Sustainable Development.
  - ✓ Progress of each country should be monitored.
- The SDG indicators are tracked at the national level by several global organizations.
  - ✓ For example, the World Bank collects the data of 351 indicators to measure the 17 SDGs of 217 countries and regions from 1990 to 2022.

Expensive data collection

Human Cost

Over 1,200 partners

Financial Cost

Around 45 billion USD

Cost Gap

Around 10 billion USD

Extract a small set of indicators (principal indicators)
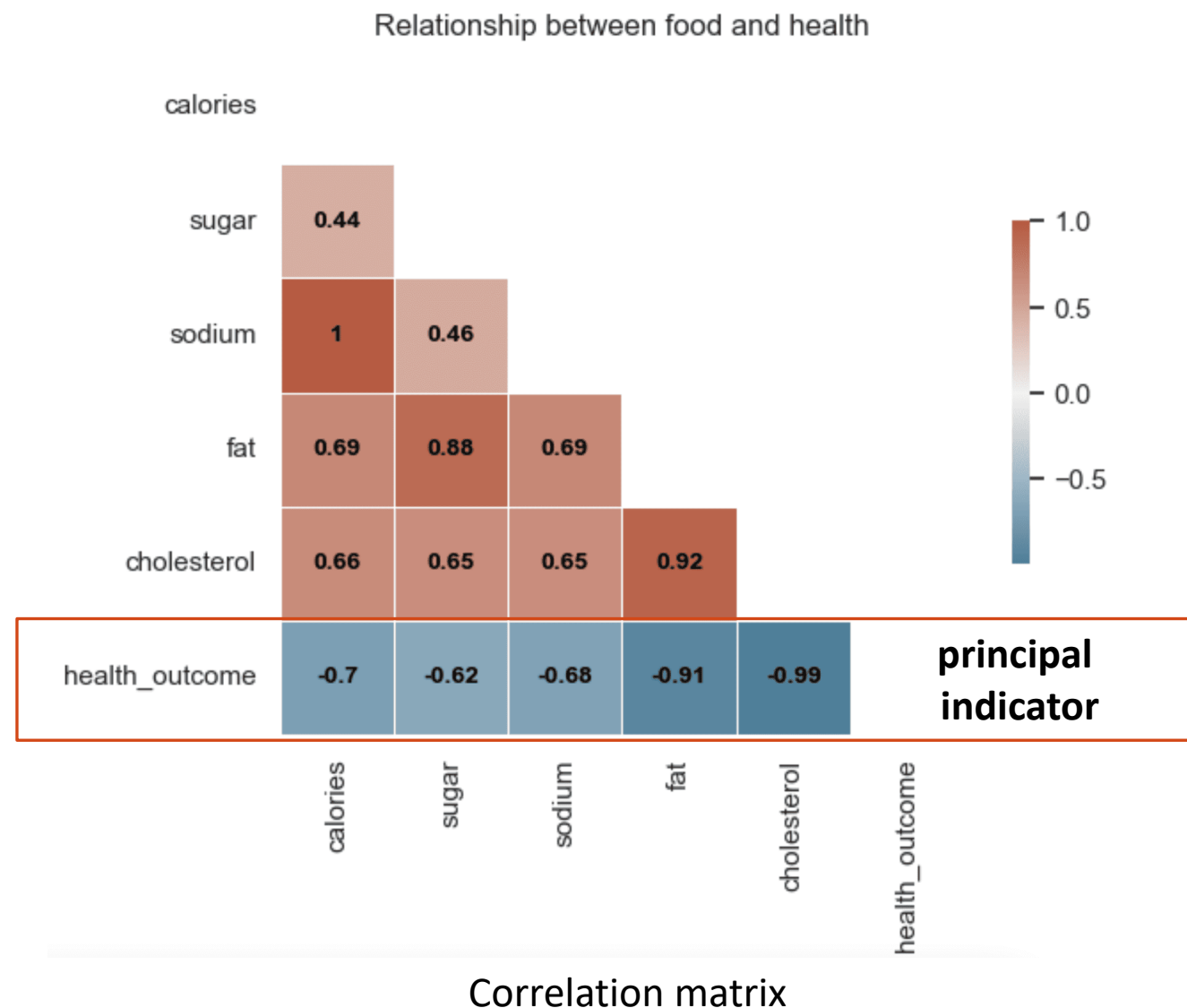to represent the most variation of all SDG indicators

Two features of principal indicators (variation & cost)

- The principal indictors should represent most of the **variation** of all the SDG indicators.
  - ✓ Statistically, principal indictors are highly correlated with other indicators
  - ✓ Principal component analysis and multilinear regression is used to quantify variation

- Variable *health_outcome* has a potential to be principal indicator.
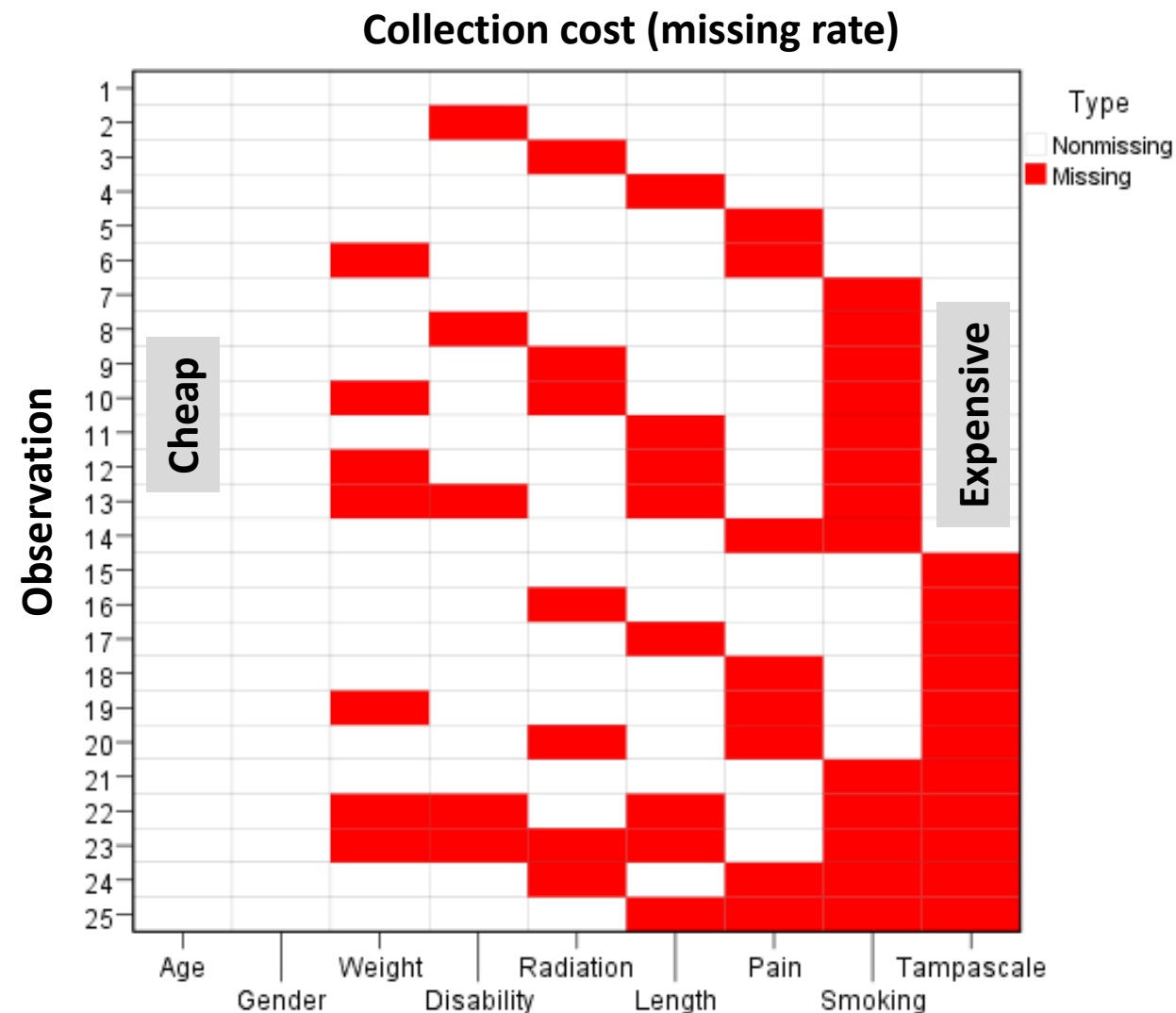 - ✓ Both positive and negative correlations are considered

Relationship between food and health

Correlation matrix

Two features of principal indicators (variation & cost)

- The principal indictors are cheapest to be collected
  - ✓ Portion of missing data (missing rate) is used to measure cost
  - ✓ Lower portion means easier to be collected and lower cost

- Data collection for variable *Age* is relatively easy
  - ✓ All data are complete

Collection cost (missing rate)

Three steps to find the best principal indicator set

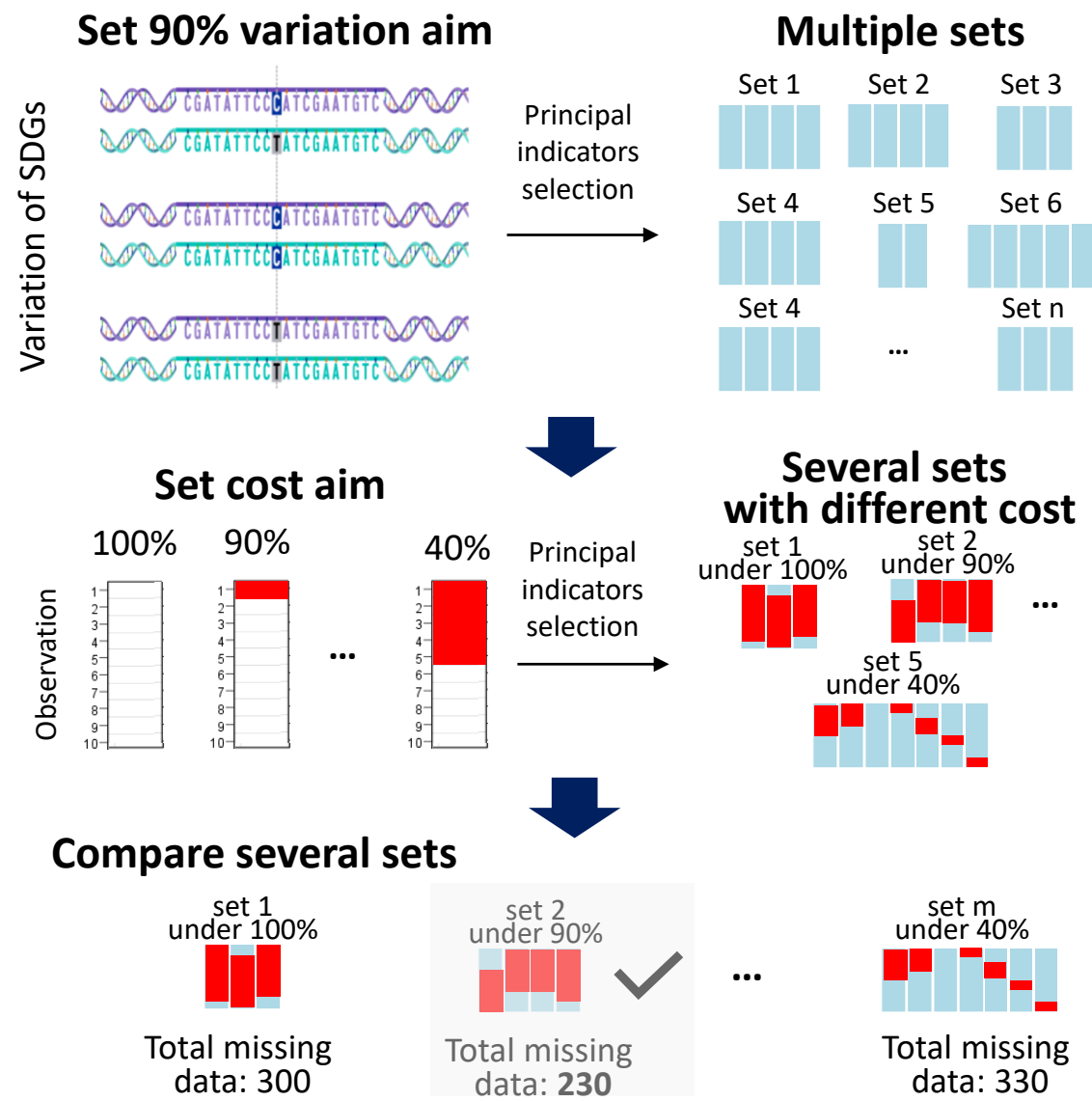- Given a variation aim, find a principal indicator set with the lowest cost
  - ✓ E.g., 90% variation
  - ✓ Infinite number of principal indicator sets meet the aim

- Set missing rate limit of SDG indicators
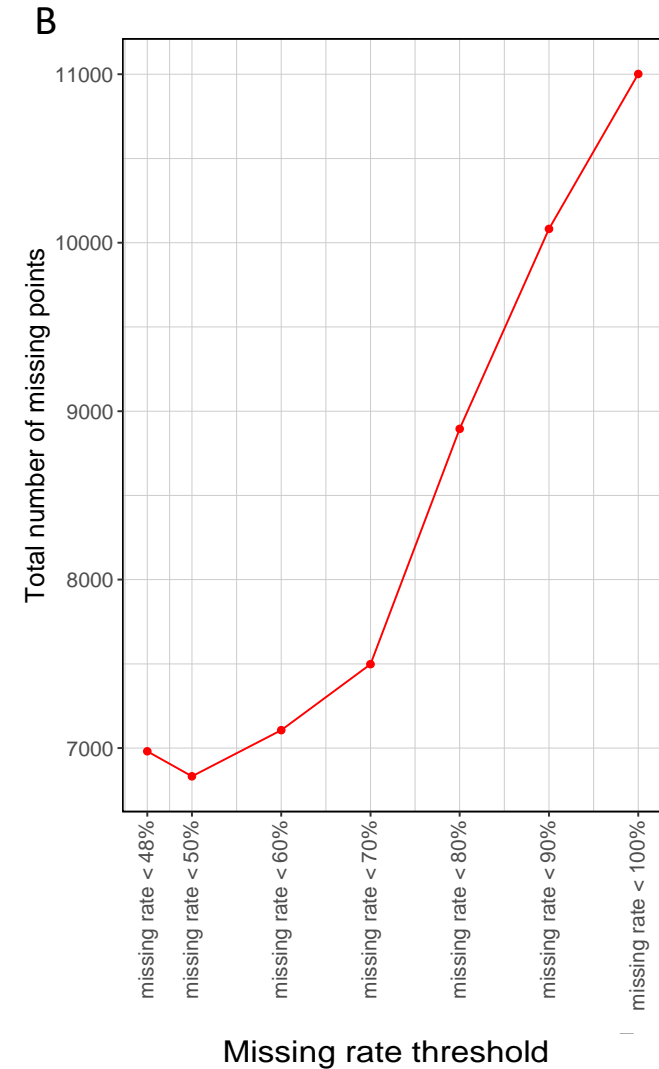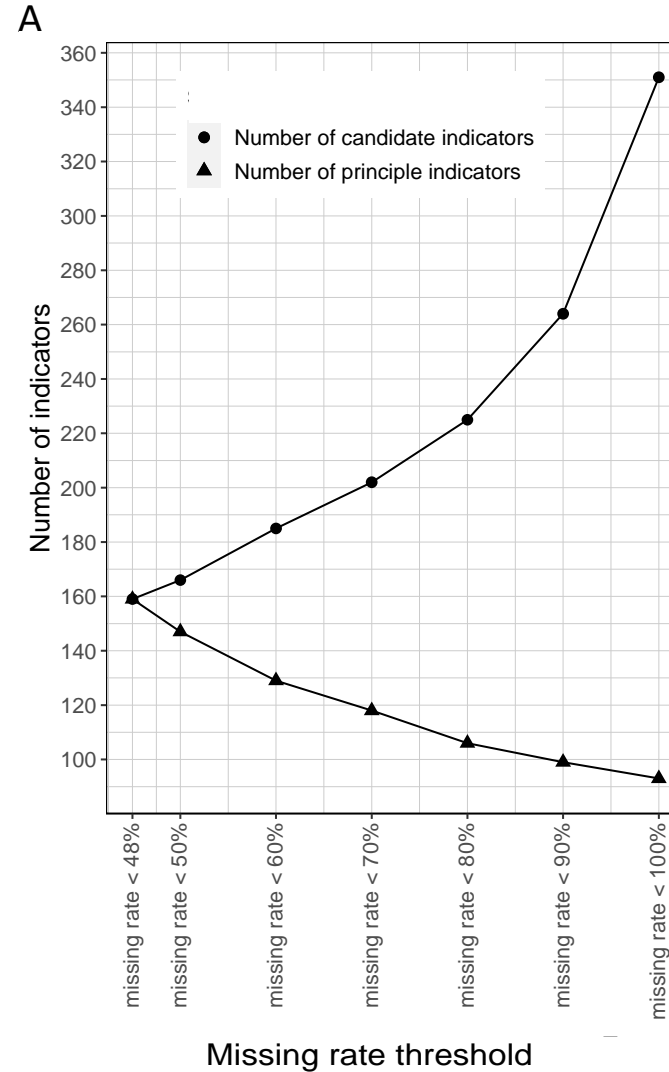 - ✓ Filter out principal indicator sets that have too many data missing

- Compare each principal indicator set and select the best one with lowest difficulty
  - ✓ lest amount of missing data

Set 90% variation aim

Variation of SDGs

Principal indicators selection

Multiple sets

Set 1   Set 2   Set 3

Set 4   Set 5   Set 6

Set 4   Set n
        ...

Set cost aim

Observation

100%   90%   40%

...

Principal indicators selection

Several sets with different cost

set 1 under 100%   set 2 under 90%

...

set 5 under 40%

Compare several sets

set 1 under 100%   set 2 under 90%   ...   set m under 40%

Total missing data: 300   Total missing data: **230**   Total missing data: 330

Principal SDG indicators selection

■ Many sets of principal indicators can explain 90% of the variation of the total 351 SDG indicators.

■ We only need 147 principal indicators to explain 90% of the variation of the total 351 SDG indicators.

A

B

147 principal SDG indicators

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83
	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124
	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
	166	167	168	169	170	171	172	173	174	175	176	177	178	179
	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206
	207	208	209	210	211	212	213
	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254
	255	256	257	258	259	260	261	262	263
	264	265	266	267	268	269	270	271	272	273	274	275	276
	277	278	279	280	281	282
	283	284	285	286	287	288	289	290	291
	292	293	294	295	296	297	298
	NA	NA
	299	300	301	NA
	302	303	304	305	NA	NA	NA	NA
	306	307	308	309	310	311	312	313	314	315	316	317
	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351

- ■ These 147 principal indicators belong to 14 of the 17 SDGs.
- ■ No indicators in three SDGs are selected as principal indicators.
  - ✓ Goal 1 "No Poverty", Goal 13 "Climate Action", and Goal 16 "Peace, Justice and institutions".
- ■ Principal indicators are correlated with other indicators
  - ✓ e.g., sanitation infrastructure is associated with poverty

351 SDG indicators and 147 principal indicators

Conclusions

We only need 147 principal indicators to represent at least 90% of the variation of 351 SDG indicators.

1 ■ We do not necessarily recommend to stop tracking non-principal indicators.

2 ■ We recommend to regularly examine the principal indicators in the future.

3 ■ We may consider developing an integrated index using principal indicators for an overall evaluation.

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Principal indicators to monitor sustainable development goals

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Thank you!

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